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THIRTY-SIXTH  
QUARTERLY REPORT  
OF THE  
PENNSYLVANIA  
BOARD OF AGRICULTURE,  
1888.

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THIRTY-SIXTH QUARTERLY REPORT  
OF THE  
**PENNSYLVANIA BOARD OF AGRICULTURE**  
FOR THE YEAR 1888.

**Members Ex-Officio.**

Hon. James A. Beaver, *Governor.*  
Hon. T. J. Stewart, *Secretary of Internal Affairs.*  
Dr. E. E. Higbee, *Superintendent of Public Instruction.*  
Col. A. W. Norris, *Auditor General.*  
Dr. G. W. Atherton, *President Pennsylvania State College.*

**Appointed by the Governor.**

	Term expires.
Dr. John P. Edge, Downingtown, Pa.,	1889
Will B. Powell, Springboro', Pa.,	1890
Col. James Young, Middletown, Pa.,	1891

**Elected by County Agricultural Societies.**

		Term expires.
Adams,	I. Garretson,	1891
Armstrong,	Jos. Painter,	1890
Beaver,	A. L. McKibben,	1890
Bedford,		1889
Berks,	G. D. Stitzel,	1889
Bucks,	E. Reeder,	1889
Blair,	J. D. Hicks,	1889
Bradford,	H. L. Scott,	1889
Butler,	W. H. H. Riddle,	1891
Clarion,		1891
Chester,	Thos. J. Edge,	1890
Centre,	E. W. Hale,	1891
Clinton,	Joel A. Herr,	1890
Columbia,	Chandlee Eves,	1891
Crawford,	M. W. Oliver,	1889
Cumberland,	C. H. Mullin,	1891
Dauphin,	G. Hiester,	1891
Delaware,	E. Harvey,	1889
Erie,	J. C. Thornton,	1889
Indiana,	W. P. Gordon,	1889
Jefferson,	J. McCracken, Jr.,	1890
Juniata,	David Wilson,	1891
Lackawanna,	H. H. Colvin,	1891
Lancaster,	H. M. Engle,	1889
Lawrence,	Sam'l McCreary,	1891
Lebanon,		1891
Lehigh,	J. P. Barnes,	1890
Luzerne,	J. B. Smith,	1891
Lycoming,	Peter Reeder,	1891
Mercer,	Robert McKee,	1890
Montgomery,	H. W. Kratz,	1890
Montour,	Thos. L. Clapp,	1889
Northampton,	A. D. Shimer,	1891
Northumberland,	John Hoffa,	1890
Perry,	F. M. McKeehan,	1891
Schuylkill,		1890
Sullivan,		1891
Susquehanna,	R. S. Searle,	1889
Tioga,	J. W. Mather,	1889
Union,	J. A. Gundy,	1890
Venango,	Wm. Gates,	1889
Warren,	F. R. Miller,	1889
Washington,	John McDowell,	1890
Wayne,	N. F. Underwood,	1888
Westmoreland,	F. Y. Clopper,	1889
Wyoming,	N. G. Bunnell,	1889
York,	W. S. Roland,	1889
	Bigler,	1891
	Kittanning,	1890
	Green Garden,	1890
	Reading,	1889
	New Hope,	1889
	Altoona,	1889
	Towanda,	1889
	Butler,	1891
	Harrisburg,	1890
	Bellefonte,	1891
	Cedar Springs,	1890
	Millville,	1891
	Conneautville,	1889
	Mt. Holly Springs,	1891
	Harrisburg,	1891
	Chester,	1889
	Avonia,	1889
	Black Lick,	1889
	Frostburg,	1890
	Port Royal,	1891
	Dalton,	1891
	Marietta,	1889
	Neshannock Falls,	1891
	Allentown,	1890
	Kingston,	1891
	Hughesville,	1891
	Mercer,	1890
	Trappe,	1890
	Limestoneville,	1889
	Bethlehem,	1891
	Milton,	1890
	Ferguson,	1891
	Montrose,	1889
	Wellsboro',	1889
	Lewisburg,	1890
	South Oil City,	1889
	Sugar Grove,	1889
	Washington,	1890
	Lake Como,	1888
	Greensburg,	1889
	Vosburg,	1889
	York,	1889



## OFFICIAL LIST.

*President.*Hon. James A. Beaver, (*ex-officio.*)*Vice Presidents.*

Dr. J. P. Edge,

Joel A. Herr,

Dr. W. S. Roland.

*Executive Committee.*Hon. James A. Beaver,  
John McDowell,  
G. Hiester,M. W. Oliver,  
E. Reeder,  
J. A. Gundy,I. Garretson,  
J. P. Barnes,  
Thos. J. Edge, (*ex officio.*)*Advisory Committee.*

G. Hiester.

J. P. Barnes,  
Thos. J. Edge, (*ex-officio.*)

J. A. Gundy,

*Secretary.*

Thos. J. Edge, Harrisburg.

*Botanist.*

Thos. Meehan, Germantown.

*Pomologist.*

Cyrus T. Fox, Reading.

*Chemist.*

Dr. F. A. Genth, Philadelphia.

*Consulting Veterinary Surgeon.*

Dr. R. S. Huidekoper, Philadelphia.

*Veterinary Surgeon.*

Dr. F. Bridge, Philadelphia.

*Microscopists and Hygienists.*

Dr. H. Leffmann, Philadelphia,

Prof. C. B. Cochran, West Chester.

*Entomologist.*

Prof. W. A. Buckhout, State College.

*Ornithologist.*

Dr. B. H. Warren, West Chester.

*Meteorologists.*

Prof. I. T. Osmond, State College,

J. L. Heacock, Quakertown.

*Mineralogist.*

Col. Jos. Wilcox, Philadelphia.

*Geologist.*

Prof. J. P. Lesley, Philadelphia.

*Stenographer.*

H. C. Demming.

## STANDING COMMITTEES—1888.

## LEGISLATION.

M. W. Oliver,  
Dr. J. P. Edge,  
John McDowell,J. A. Gundy,  
W. S. Roland,  
J. P. Barnes,N. F. Underwood,  
E. Reeder,  
Thos. J. Edge.

## FRUIT AND FRUIT CULTURE.

Joel A. Herr,  
G. Hiester,  
G. D. Stitzel,  
John Hoffa,  
F. R. Miller,Will B. Powell,  
H. M. Engle,  
H. H. Colvin,  
R. S. Searle,  
C. T. Fox,Dr. J. P. Edge,  
N. F. Underwood,  
F. M. McKeehan,  
Dr. J. Calder,  
H. A. Longsdorf,

## WOOL AND TEXTILE FIBRES.

John McDowell,  
M. W. Oliver,  
S. P. Eby,Dr. E. Harvey,  
A. O. Hiester,J. W. Axtel,  
R. S. Searle,

## FARM IMPLEMENTS.

Peter Reeder,  
Chandlee Eves,  
M. W. Oliver,  
W. B. Powell,E. Reeder,  
R. S. Searle,  
Wm. Gates,N. F. Underwood,  
I. Garretson,  
E. W. Hale.

## DAIRY AND DAIRY PRODUCTS.

Eastburn Reeder,  
M. W. Oliver,  
Prof. C. B. Cochran, (Analytical Chemist.)R. S. Searle,  
Chandlee Eves,I. Garretson,  
H. L. Scott.

## POULTRY.

John Hoffa,  
E. B. Esh,

John A. Follmer,

Oliver D. Schock.

## GRASSES AND FODDER CROPS.

H. M. Engle,  
N. F. Underwood,  
N. G. Bunnell,M. W. Oliver,  
E. Reeder,John Hoffa,  
I. Garretson.

## WATER SUPPLY FOR FARM BUILDINGS.

R. S. Searle,  
J. C. Thornton,

Dr. J. P. Edge,

N. F. Underwood.

## ROADS.

J. A. Gundy,  
A. M. Fuller,  
S. F. Hoffa,  
Wm. Benedict,J. P. Barnes,  
John M. Miller,  
John A. Woodward,  
H. W. Kratz,J. W. Hickman,  
Wm. L. Graul,  
John H. Wogan,  
Thos. J. Edge.

## CEREAL CROPS.

I. Garretson,  
N. F. Underwood,  
E. W. Hale,  
D. Wilson,  
H. W. Kratz,  
W. S. Roland,M. W. Oliver,  
G. Hiester,  
H. M. Engle,  
J. P. Barnes,  
T. L. Clapp,  
H. L. Scott,R. S. Searle,  
J. A. Gundy,  
H. H. Colvin,  
E. Reeder,  
J. McDowell,  
W. Gates.

## SILK AND SILK CULTURE.

David Wilson,  
J. D. Hicks,  
J. A. Gundy.J. A. Herr,  
N. F. Underwood.H. W. Kratz,  
E. W. Hale,

## ORNITHOLOGY.

Dr. B. H. Warren,  
G. B. Sennet,  
G. W. Thomas,M. W. Oliver,  
C. J. Pennock,N. F. Underwood,  
Thos. J. Edge.

## FORESTS AND FORESTRY.

Wm. Gates,  
N. F. Underwood,  
R. S. Searle,J. A. Herr,  
W. S. Roland,  
Thomas Meehan,I. Garretson,  
Chandlee Eves,  
H. L. Scott.

## APIARY.

M. W. Oliver,  
I. Garretson,  
W. Gates,J. Shallcross,  
H. H. Brown,  
Arthur Todd,Mrs. M. L. Thomas,  
D. Videts,  
W. A. McLean.



## MINUTES OF THE ANNUAL MEETING—1888.

[Held at Harrisburg, Pennsylvania, January 25 and 26, 1888.]

WEDNESDAY MORNING, *January 25, 1888.*

Board called to order at 9.15 A. M., by Capt. M. W. Oliver, vice-president, in the chair.

On motion of W. S. Roland of York, seconded by Dr. J. P. Edge, the chair was authorized to name a committee on credentials of members elect and delegates; Chair named as said committee Messrs. Roland, Herr and Miller.

His Excellency Governor Beaver then took the chair and addressed the Board upon the subject of Forestry.

The regular order of the programme was then taken up and Dr. J. M. Anders read an essay upon "Forests as Sanitary Agents," and was followed by Professor W. A. Buckhout, of the Pennsylvania State College, with an essay on "The Mountain Region of Central Pennsylvania and its relations to Forestry."

Professor J. T. Rothrock, of the University of Pennsylvania, addressed the board on the work of the Pennsylvania Forestry Association and was followed by Dr. E. E. Higbee, Superintendent of Public Schools, in an address on Arbor day in the public schools.

The chair then declared the essays and address open to discussion and also that the general question of forestry was open for discussion which should be confined to its sanitary and economic bearings only.

Discussion participated in by Messrs. Wilson, A. O. Hiester, Oliver, Rothrock, Roland, Higbee, Lundy, Underwood, Searle, McCreary, Fernow, Anders, Kratz, Smith, McKeegan, Governor Beaver and Secretary.

On motion of the Secretary, the session was extended one half hour, and the subject still further discussed by Messrs. Dr. J. P. Edge, Lundy, Meehan, Engle, Stitzel and Wilson.

On motion adjourned until 2 P. M.

WEDNESDAY AFTERNOON, *January 26, 1888.*

Board called to order at 2 P. M., by Capt. M. W. Oliver, in the chair.

B. E. Fernow, Esq., of the Forestry Division of the United States Department of Agriculture, addressed the Board upon "The Forestry Legislation Practicable for Pennsylvania," and was followed by N. F. Underwood, member from Wayne, by an essay in answer to the question "Has the Destruction of Timber in Pennsylvania reached the Danger Line?"

Professor E. J. James, of the University of Pennsylvania, addressed the Board upon "The Relation of the State to Forests," and was followed by Thos. Meehan, Botanist of the Board, in address upon "Practical Forestry."

The chair then declared the legislative side of the forestry question open for discussion, which was participated in by Messrs. Oliver, Eby, Miller, Dr. J. P. Edge, Powell, Harvey, Gundy, Barnes, Meehan and Secretary.

On motion adjourned until 7.30 P. M.

WEDNESDAY EVENING, *January 25, 1888.*

Board called to order at 7.30 P. M., by Capt. M. W. Oliver, in the chair.

Committee on Credentials, through W. S. Roland, chairman, reported that they found that the following gentlemen had been elected by their respective societies as members of the Board, and in the opinion of the committee, were entitled to membership in the Board, viz: Columbia, Chandlee Eves; Lawrence, Samuel McCreary; Perry, F. M. McKeegan; Lycoming, P. Reeder; Juniata, David Wilson; Luzerne, J. B. Smith; Lackawanna, H. H. Colvin; Centre, E. W. Hale; Dauphin, G. Hiester; Berks, G. D. Stitzel; Cumberland, C. H. Mullin; Adams, I. Garretson; Northampton, A. D. Shimer.

They also reported that the following delegates were present with credentials:

Pennsylvania State Agriculture Society, Hon. A. O. Hiester; State Horticultural Association, Cyrus T. Fox, H. C. Snavley and H. S. Rupp; Warren County Farmers' Club, C. S. Stone; Grange No. 697, P. of H., John H. Epler; Lancaster County Agricultural Society, J. F. Whitmer and James Wood.

On motion the report of the committee was accepted and the members elect declared entitled to seats in the Board.

The Secretary announced that vacancies existed in the representation of the counties of Schuylkill and Somerset, on account of the death of their representatives, and in the counties of Bedford, Butler, Lebanon and Sullivan, by non-election.

He also announced that Governor Beaver had appointed Col. James Young a member of the Board for three years ensuing.

Members present, Hon. James A. Beaver, Dr. E. E. Higbee, G. W. Atherton, Dr. J. P. Edge, Col. James Young, Will B. Powell, and Messrs. Garretson, Stitzel, Reeder (of Bucks), Scott, Hale, Herr, Eves, Oliver, Mullin, Hiester, Harvey, Thornton, Wilson, Colvin, Engle, McCreary, Barnes, Smith, Reeder (of Lycoming), McKee, Kratz, Clapp, Hoffa, McKeegan, Searle, Gundy, Miller, McDowell, Bunnell, Roland and Secretary. Honorary officers present, Prof. Buckhout, Entomologist, Thomas Meehan, Botanist, and, H. C. Demming, Stenographer.

The Chair named Messrs. Underwood and Barnes as tellers and directed that the election of officers for 1888 be carried out in accordance with the programme.

Messrs. Oliver, Dr. Edge, Herr, Reeder, Barnes and Roland were nominated as vice presidents; after a ballot the tellers announced that Messrs. Edge and Herr had been elected, but that there was a tie vote as to the Third Vice President; a second ballot having been ordered the tellers declared W. S. Roland elected as Third Vice President.

Messrs. McDowell, Hiester, Oliver, Reeder (of Bucks), Gundy, Garretson and Barnes, were nominated as members of the Executive Committee, and on motion of Mr. Herr, the Secretary was directed to cast the ballot of the Board for them.

Thos. J. Edge was nominated as Secretary, and the chairman directed to cast a ballot for him.

On motion of Dr. Roland, the Executive Committee were authorized to name the chairman of each standing committee and report the names at a subsequent session of the Board.

The Executive Committee was granted permission to meet during the sessions of the Board.



Mr. Hiester then read an obituary notice of J. G. Zerr, late member from Berks.

On behalf of the committee on resolutions, Dr. W. S. Roland presented the following appropriate resolutions of respect, of which the Secretary was directed to furnish a copy to the family of the deceased member :

WHEREAS, We have learned with sincere sorrow that death has removed from our midst our esteemed friend and late member, J. G. Zerr, of Berks; therefore, be it

*Resolved*, That in his death we recognize the hand of God, and bow in humble submission to his will.

*Resolved*, That this mournful event has deprived us of one whose intimate association and honorable character had won esteem and affection and who on all occasions proved to be a most worthy, efficient and energetic member of the Board of Agriculture.

*Resolved*, That we mourn the loss of our late fellow member and do most sincerely offer to the members of his bereaved family our condolence and sympathy in their great affliction.

*Resolved*, That the Secretary transmit a copy of these resolutions to the family of the deceased and that the same be recorded in the minutes of the Board.

(Signed)

WM. S. ROLAND,  
J. A. HERR,  
H. M. ENGLE.

Remarks in reference to the death of Mr. Zerr were made by Messrs. Barnes, Stitzel, Searle, Roland and Wilson.

Reports of standing committees having been called for, Mr. McDowell, of Washington, on behalf of the committee on Wool and Textile Fibers, presented a full report which he illustrated by samples of the following kinds of wool, viz : Wool tops, wool waste No. 1, wool waste No. 2, fine Australian wool, new clip unwashed Australian wool, Irish washed wool, East India washed wool, Mogadore washed wool, raw unmanufactured wool of commerce, camels' hair tops, camels' hair noils, East India carpet wool, and the best grades of carpet wool noils.

On motion of Mr. Herr, the Board then proceeded to fix the place of next meeting; Mr. McKee, named Mercer; Mr. Stone, named Warren; and Mr. Reeder (by request of Mr. Garretson), named Gettysburg; after discussion, Warren was selected as the place of next meeting, and the second week of June fixed as the time.

On behalf of the Pennsylvania State Agriculture Society, Mr. McDowell, of Washington, suggested that the State Board of Agriculture, the State Agriculture Society, the State Horticultural Association and the State Dairymen's Association, under the auspices of the State Board of Agriculture, should hold a joint Local Farmers' Institute at some time and place to be agreed upon by a joint committee of the four organizations.

After partial discussion, it was on motion of Mr. Roland, seconded by Mr. Kratz, resolved to appoint a committee of five to whom the invitation should be referred with directions to report as soon as practicable. The Chair named Messrs. Roland, Hale, Powell, Wilson and Oliver as the committee.

The Executive Committee reported the following appointments for which they asked the confirmation of the Board :

Advisory Committee, Messrs. Hiester, Barnes, Gundy; they named

the following as chairmen of the respective committees: Legislation, M. W. Oliver; Fruit and Fruit Culture, J. A. Herr; Forests and Forestry, W. Gates; Apiary, M. W. Oliver; Silk and Silk Culture, D. Wilson; Wool and Textile Fibers, J. McDowell; Roads and Road Laws, J. A. Gundy; Farm Implements and Machinery, P. Reeder; Cereal Crops, I. Garretson; Grasses and Fodder Crops, H. M. Engle; Dairy and Dairy Implements, E. Reeder; Ornithology, Dr. B. H. Warren; Poultry, J. Hoffa; Water Supply to Farm Buildings, R. S. Searle.

The committee also reported the names of the following honorary officers and recommended their confirmation by the Board, viz :

Botanist, Thomas Meehan, Germantown; Pomologist, C. T. Fox, Reading; Chemist, Dr. F. A. Genth, Philadelphia; Consulting Veterinary Surgeon, Dr. R. S. Huidekoper, Philadelphia; Veterinary Surgeon, Dr. F. Bridge, Philadelphia; Microscopists, Dr. H. Leffmann, Philadelphia, and Prof. C. B. Cochran, West Chester; Ornithologist, Dr. B. H. Warren, West Chester; Meteorologists, Prof. I. T. Osmond, State College, and J. L. Heacock, Quakertown; Mineralogist, Joseph Willcox, Philadelphia.

On motion the report of the committee was received and the appointments named by then declared made.

The committee to whom the resolution of Mr. McDowell relative to a joint convention of the different agricultural organizations of the State, reported as follows :

"While the State Board of Agriculture sympathizes deeply and earnestly with every organization aiming at the advancement of every department of agriculture in the State, and will do everything in its power to promote the success of the same, it does not feel authorized, under the law constituting it, to join in any such convention of different organizations under its auspices; it hereby cordially invites the State Agricultural Society, the State Horticultural Association, and the State Dairymen's Association, and any other association of kindred aims, to send delegates to any of its meetings."

(Signed)

J. P. BARNES,  
D. WILSON,  
M. W. OLIVER,  
E. W. HALE,  
W. B. POWELL,  
*Committee.*

After discussion the action upon the report of the committee was deferred until next meeting.

Adjourned until 9 A. M. Thursday morning.

THURSDAY MORNING, *January 26, 1888.*

Board called to order at 9.15 A. M., by Dr. J. P. Edge in the chair.

Mr. Wilson of Juniata, offered the following resolution, which, after discussion, was referred to the committee on Legislation :

*Resolved*, That in view of the expected revision of the tariff laws by the present Congress, our Senators and Representatives be requested to make a strong and earnest effort to have foreign raw silk cocoons coming into this country, tariffed at the same rate as the manufactured article, or at least to have the present tariff so modified as to enable the manufacturer in this country to pay the full value for home-raised cocoons.

The report of the Legislative Committee of the State Forestry Asso-



ciation was received, read and referred to the committee on Legislation.

H. M. Engle read an essay on "The Management of Milk and Milk Cows," and was followed by M. W. Oliver with an essay on "The Dairy—Then and Now."

John Hoffa read an essay on "The Advantages of the Creamery to the Farmer," and fully illustrated his essay by samples of milk of different values, showing the percentage of butter, whey and cheese in each. At the close of the essay the chair declared the general subject of the dairy open for general discussion, which was participated in by Messrs. Hoffa, Miller, Searle, Gundy, Roland, Oliver, Reeder (of Bucks), Underwood, Colvin, Wilson, Engle, Young, Harvey, Herr and Secretary.

Governor Beaver here took the chair.

Hon. John A. Woodward read an essay on "The Relation of the Public Schools to the Farmer."

Mr. Powell of Crawford, offered the following, which was unanimously adopted:

*Resolved*, That in view of the wide prevalence of a contagious form of tuberculosis among the dairy herds and other horned cattle of eastern Pennsylvania, a disease which renders both the flesh and milk product of the affected animal unhealthy or unsafe as food, this Board deems it expedient that the laws, both State and National, for the suppression of contagious pleuro-pneumonia or cattle plague should be promptly extended to cover the disease in question.

On motion adjourned until 2 P. M.

THURSDAY AFTERNOON, *January 26, 1888.*

Board called to order at 2 P. M. Dr. J. P. Edge in the chair.

Dr. E. Harvey, member from Delaware, addressed the board in relation to "The Near Future of the Farming Interest."

On motion adjourned to meet at Warren during the second Monday in June.

During a session of the Board the Secretary presented his financial report as follows:

Total amount of all appropriations, . . . . .	\$5,750 00
Total amount of all expenditures, . . . . .	3,405 02
Total amount yet available for all purposes, . . . . .	\$2,344 98
Appropriations for expenses of members, . . . . .	\$1,500 00
Amount expended for expenses of members, . . . . .	901 82
Amount yet available for expenses of members, . . . . .	\$598 18
Amount appropriated for local farmers' institutes, . . . . .	\$3,000 00
Amount expended for farmer's institutes, . . . . .	1,834 74
Amount yet available for farmer's institutes, . . . . .	\$1,165 26
Amount of appropriation for investigating diseases, . . . . .	\$500 00
Amount expended for investigating diseases, . . . . .	337 46
Amount yet available for investigating diseases, . . . . .	\$162 54

Amount of appropriation for office expenses, . . . . .	\$750 00
Amount expended for office expenses, . . . . .	331 00

Amount yet available for office expenses, . . . . .	\$419 00
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The secretary reported institutes and meetings as having been held as follows:

Bellefonte, . . . . . June 8th and 9th.	New Castle, . . . . . December 20th and 21st.
Montrose, . . . . . October 5th and 6th.	Washington, . . . . . December 27th and 28th.
Montrose, . . . . . October 12th and 13th.	Mackeyville, . . . . . December 28th and 29th.
Mifflintown, . . . . . November 24th and 25th.	Millville, . . . . . January 11th, 12th and 13th.
Newtown, . . . . . Nov. 30th and Dec. 1st.	Atglen, . . . . . January 19th and 20th.
Lewisburg, . . . . . December 7th and 8th.	Harrisburg, . . . . . January 25th and 26th.

He also reported that institutes would be held as follows:

Pottsgrove, January 31st and Feb. 1st.	Hatboro', . . . . . February 22d and 23d.
Lancaster, . . . . . February 1st and 2d.	Mifflinburg, . . . . . February 23d and 24th.
Honesdale, . . . . . February 1st and 2d.	Tunkhannock, . . . . . Feb. 29th and March 1st.
Gettysburg, . . . . . February 8th and 9th.	York, . . . . . March 15th and 16th.
Oxford, . . . . . February 15th and 16th.	

Other institutes have been partially arranged for, but no other dates had been fixed.

## ADDRESSES, PAPERS AND DISCUSSIONS OF THE ANNUAL MEETING.

### FORESTS AS SANITARY AGENTS.

By J. M. ANDERS, M. D., *Philadelphia, Pa.*

For ages back the history of not a few countries of our globe have furnished incontestable proof of the fact that extermination of the forest growth causes infertility of the soil and insalubrity of climate. Prior to the last decade the sanitary influences of forests had not however attracted the attention of the hygienist, though questions such as the one we propose to consider, affecting as they do the public health, are paramount to all others.

The manifold salutary effects of the woodland may be conveniently discussed under six heads as follows:

*First*, The conservative influence of the forests upon the moisture of the soil and running streams.

*Secondly*, Their power to lessen the prevalence of certain endemic and epidemic diseases, notably cholera, typhoid fever and malaria.

*Thirdly*, Their mechanical climatic effects.

*Fourthly*, Their influence to increase the degree of saturation as well as to maintain the equilibrium of the humidity of the air.

*Fifthly*, Their office of atmosphere purification by means of the ozone generated by growing vegetation.

*Sixthly*, The advantage of their climatic influence in the presence of health stations.

#### (1.) The Conservative Influence of Forests upon the Soil and Running Streams.

That springs, streams and rivulets owe their origin and permanence in many instances to the presence of forests properly located, with re



spect to their head waters, has been shown conclusively by the fact that in many districts where they have disappeared, in consequence of forest destruction, they have reappeared after proper re-forestation. The explanation of this action of the woodland is to be found in the study of the forest soil which acts as a large storage basin from whose bountiful supply the springs and streams are fed. The influence of woods under discussion is frequently of sanitary importance to the inhabitants of large cities, as it maintains and regulates their water supply. Without favoring excessive moisture, forests, under ordinary circumstances, preserve a permanent degree of humidity of the soil. How can we account for this happy influence on the part of Sylvan nature? To this end we have the following facts: The evaporation from a forest soil is only about one-fourth as great as from an open space, and the vegetable mold generally carpeting the woodland soil sucks up the rain water which it in turn gives up slowly to the superficial strata, while the roots of the trees which extend into the earth to great depths, conduct the major portion of the rain fall down to the net work of terminal rootlets where it is safely retained for purposes of absorption. Obviously this conservative action of woods is particularly beneficial on the hillsides or steep elevations, and affects greatly agriculture and other industries. As sanitarians we are, however, concerned only with the study of the relation which this permanent condition of the moisture of the soil holds to certain diseases.

(2.) The Power of Forests to Lessen the Prevalence of Certain Endemic and Epidemic Diseases.

Time is wanting to treat this question here as fully as it deserves, hence, we shall limit the discussion to a few general considerations.

It has long been a well-established fact in medical science that great and sudden variations in the level of the ground-water eminently favors out breaks of malarial fever; a prolonged low-ground water level has also been recently shown to be closely connected with the predominance of typhoid fever. Having shown forests to be operative in preserving a uniform degree of moisture in their soil, there can be no gainsaying their potency in securing freedom from typhoid fever and malaria under the conditions stated. Where the soil would be otherwise, exhibiting extremes in the level of the ground-water, as, for instance, in sloping unwooded surfaces, the effect of the woodland would be most happy. As a rule, however, malaria is generated in low, damp, marshy localities having no natural sub-soil drainage. Here artificial drains, with a view of ridding the malarial soil of its redundant moisture, have been shown to be effective in arresting the progress of the disease. To accomplish the same result, trees cultivated with some precision of detail in highly malarial regions have been known to be quite effective, the trees drinking up the excess of moisture and giving it out through their leaves. Upon this point Mr. D. Horwitz, Forest Conservator of Denmark, has pertinently observed: "Swamps and morasses are created in Ireland from the want of trees to drink up the superfluous moisture;" and Gimlet, in Algeria, tells us that extremely malarious districts have been rendered quite harmless in four or five years by the absorbent action of and evaporation from the *Eucalyptus globulus*.

In this connection it should be pointed out that trees in patches, or even heavy shrubbery, placed between the originating points of malaria and human habitations, afford protection to the inmates from ma-

laria diseases, a result that is undoubtedly brought about in a manner purely mechanical.

Prof. Max von Pettenkofer has shown how forests and plantations serve as efficient preventives of that dread malady, cholera. Both the virulence and frequency of its occurrence are also greatly increased by variations in the moisture of the soil to the extent either of rising above or falling below a certain level; while conversely when the extremes in the markings of the ground-water remain within narrow limits, as is the case in wooded districts, the disease is not so likely to become epidemic. To corroborate this dictum we have the recorded observations, drawn from the side of practical experience by numerous competent authorities, among whom appear the names Prof. Max von Pettenkofer, Dr. Bryden (president of the statistical office in Calcutta), Dr. Murray (inspector of hospitals), and Mr. Reinhardt (president of the Saxony Medical College) and others, though time forbids my citing these authors.

3. Their Climatic Mechanical Effects.

Forests exert a favorable climatic influence by acting as wind-breaks. Whilst their effect to oppose resistance to the passage of wind currents has been long known and fully appreciated, it is none the less of great practical importance; obviously trees in clumps or belts are well adapted to break the force of the wind, and in so doing they serve to shelter the inhabitants and humbler vegetation to the leeward during the cold season. In summer the woods protect from drying winds, which enhance evaporation from living vegetation, causing blighted crops. For a similar reason woods are in numerous localities needful on our coasts. On striking the land the sea breezes become warmed, whereby their capacity for moisture is greatly increased, and it follows that they absorb with avidity the moisture of the earth over open spaces. Obviously then forests by intercepting cold currents on the one hand and drying winds on the other, mollify extremes of temperature, rendering summer less sultry and winter less severe.

And in this wise forests lengthen the relative season of vegetable growth and development. Throughout our prairie States forests for their effect in breaking the force of wind currents are an absolute necessity, and frequently are planted. It should be pointed out here that the temperature of the forest air in summer is several degrees lower than that of the external air, and this fact may be accounted for in part by the cooling influence of the shade, and in part, as shown by Prof. Ebermayer, by the circumstance that the temperature of the trees of the forests is found to be about five degrees "F." lower than the air of the forest. But there is still another influence exercised by forests by means of which they cool the atmosphere in summer. As will be presently shown, one of the leading parts performed by woods in nature's wise economy is to aid in maintaining a uniform standard of the atmospheric humidity; and it has been clearly established that any increase in the amount of aqueous vapor in the air reduces to a considerable extent the temperature. According to Dr. Frankland, the moisture in the air of England reduces the temperature from fifteen to twenty-five degrees. (Dr. Blodgett, Jour. Am. Med. Assn., August 23, 1884.)

This increase of the normal temperature, as we go from the sea towards the interior in Western Europe and Asia, is beautifully com-



pensated for by the presence of forests, so that there are places far from the sea that are cooler than the shore itself. This is true, N. Wœikoff (Petermans Mittheilungen) tells us, "in Bosnia, where the summer is five to six degrees cooler than in Herzegovina, on account of the woods."

(4.) Forests Increase the Relative Humidity and Maintain the Equilibrium of Moisture in the Air.

That certain organic processes of growing trees affect favorably certain meteorological elements is to-day quite generally conceded. Now, the most important influence exerted by forests upon the climate is that exercise upon the humidity of the air. Forests are great natural dispensers of moisture.

"Wherever a fair proportion of woodland exists a considerable influence is thereby exerted upon the hydro-meteorology of the region. This is due to a function actively carried on by plant life in general, viz: transpiration, and its high importance demands a moment's consideration. As the result of careful experimentation, it has been found that a single square foot of leaf surface in the case of soft, thin-leaved plants, will, during fair weather, exhale aqueous vapor at the rate of one and a quarter ounces daily. At night the rate is only about one-fifth as rapid as during the day, and during rainy weather there is absolutely no evaporation. Upon a moment's reflection on the above rate of transpiration, it must become evident that the amount of moisture given to the atmosphere by a forest is really marvelous. In order to give a more definite conception of the vastness of this process it may be pardonable to introduce here a few deductions, based upon an experimental study of the comparative evaporation from leaves, the soil and water. 1. It was found that transpirations from the forest was twice as great as from an equal area of open soil even when the latter was kept moist. 2. That more water was emitted from a forest than from an equal body of water. Under these circumstances it will not be considered an exaggeration to say that there exists a relationship between forest growth and atmospheric humidity.

Transpiration, it is of the utmost importance to observe, is not governed by precisely the same laws as evaporation from water or soil, the latter process being chiefly under the influence of temperature, range and the degree of saturation of the air, while the former, transpiration, is mainly excited by the solar rays. As compared with terrestrial evaporation, therefore, the moisture transpired by vegetable life is less variable. Thus a more nearly uniform degree of moisture is secured in the vicinity of forests than is found elsewhere. This statement receives convincing confirmation from another fact, namely, forests trees, owing to the great depths to which their roots extend, are at all times abundantly supplied with moisture for the uses of nutrition and transpiration. This greater equability of the atmospheric moisture derived from forests implies significant advantages far reaching in their application to the laws of sanitation. The quantity of vapor of water contained in the air is small indeed, there being only about four and a half per cent., and, although it is everywhere present, its ratio is very variable.

The degree of saturation, as shown by ingenious observations by Professor Tyndall, greatly influences the climate, and more particularly the temperature range. He has shown conclusively that the

aqueous vapor of the air has the power to intercept nocturnal terrestrial radiation—obeying the laws of gaseous bodies in this respect. When the atmosphere contains a proper share of moisture permanently then is there little daily variation of the temperature, while on the other hand a low degree of humidity admits of active nocturnal radiation, and consequently a great fall of the temperature during the night. When the quantity of moisture is constantly changing it is quite obvious that the temperature must be equally variable. Now, the greatest objection that can be urged against dry climates is this enormous range of the daily temperature. The aqueous vapor in the air forms a sort of canopy—though invisible—floating between the warm earth beneath and the chilly air above, impeding, as before stated, more or less effectually the radiation of the earth's caloric. The thrifty housewife gives us a homely illustration of this when she spreads a covering over her plants on nights when she fears frost. The aqueous vapor of the atmosphere constitutes a cloak which is quite as necessary to vegetable and animal life as clothing is to man.

To demonstrate that the vapor in the air is the main agency in regulating the nocturnal radiation from the earth's surface, we also have the testimony of competent meteorologists. The results of observation made by Colonel Richard Strache, showing the relations between the tension of the aqueous vapor of the air and the fall of the thermometer during the night, should be briefly stated: "When the tension of vapor was 0.888 inches, the fall of the thermometer was 6° F., and when the tension was only 0.435 inches, the fall amounted to 16.5° F." Doctor Livingstone has observed a great excess in nocturnal chilling when the air is dry, over that which occurs when the atmosphere is laden with moisture.

In the southern and central portions of Africa he found, during the month of June, the thermometer early in the morning from 42° to 50° F., at noon 94° to 96° F., or a mean difference of 48° F., between sunrise and mid-day. From the results of the experiments by Prof. Tyndall, it is clear that forests, on account of their power, as we have shown, not only to increase somewhat the degree of saturation of the air, but also to maintain a greater uniformity in the amount of these substances, tend to establish everywhere an equable climate, with slight daily fluctuations of the temperature, which, be it remembered, is, so far as the all-important question of public health is concerned, of far higher importance than the average temperature of the seasons. It is obvious that an office such as this on the part of forests must tend to create public sentiment in favor of a system of silviculture worthy of the name. From the results of our experimental labors it has been shown that when the ratio of forests' growth to the total area is as one to four, an equivalent of twelve inches of the rainfall during the annual period of vegetable growth may be accounted for by transpiration—a fact seemingly furnishing ground for thinking that timber land has the power of increasing the annual rainfall. But, since the total annual evaporation and precipitation bear a constant relation, it would not be reasonable to hold that forests increase the total annual precipitation.

On the other hand, the woodland does possess a favorable local influence upon precipitation, permitting gentle showers, and, within given areas of space and limits of time, influences both the amount and distribution. By increasing the frequency of light rains, forests tend to obviate drought. The woodland also produces abundant



dews; like rain dew is formed more readily in a moist than in a dry air, hence the slight increase of moisture found in the vicinity of forests is well calculated to favor the production of dews. In certain portions of our globe, Egypt and Arabia for example, nearly all moisture which finds its way to the earth is in the form of mists and dews. In this connection it should be stated that there is, in the present field of inquiry, great need of further observations, having for their aim the framing of a comparison between the rainfall of wooded and unwooded districts, and extending over long periods together. Of such a character as this are the very properly conducted experiments of L. Fantiat and A. Sartiaux, who found the total rainfall for six months over an extensive forest to be 192.50 M. M., over against 177 M. M. in the open air, just 300 M. M. from the forest; difference in favor of the forest, 15.50 M. M. The degree of humidity that the open air showed was 61.7° F., in the forest, 63°; the difference in favor of the forest being 1.30° F.

We now have to consider another plant function which brings forests into prominence as hygienic agents, to wit: the generation of ozone.

Than this active body there is no substance of higher importance to the sanitarian for study and consideration. Although our knowledge concerning its exact hygienic value is as yet imperfect, there can be no question that, owing to its strong oxidizing properties, it is the most potent natural purifying agent of the atmosphere, ridding this medium of organic impurities universally present, though not as some contend, of disease-producing germs.

Prof. Pettenkoffer thus comments upon the sanitary value of ozone: "It is a constant purifier of the atmosphere from all organic matter which passes into it and might accumulate."

"The air would have been long ago filled with the vapors of decomposition if it were not for ozone, which oxidizes all that is oxidizable, if only time be allowed for it, and not too much is expected at once."

The above high opinion of ozone is shared by Prof. Kedzie, of the University of Michigan, who tells us, "its presence or absence must have a controlling influence over the vital powers; and when we consider," he continues, "that this material is present in such variable quantity in the medium which surrounds us every moment of our lives, and whose action 'pauses not for matin nor for vesper,' it seems to me no one can deny that its influence on human health must be most significant."

Time would fail me in an attempt to present to this body a detailed account of all the experiments which have been made to establish the power of growing plants to generate ozone. Suffice it to say that this proposition is founded upon careful observations which have been given elsewhere,\* and from which the following conclusions have been formulated:

(1.) That flowering plants, including odorous and inodorous ones, generate ozone or convert the oxygen of the air into this substance. Those flowers giving off perfumes, however, develop more actively than those that do not.

(2.) So far as tested, scented foliage possesses the power to generate ozone, and in the case of the pine or the hemlock foliage to a marked degree.

\* For a full statement of these researches the reader is referred to a work on House Plants as Sanitary Agents, page 115 to 140.

(3.) That inasmuch as no re-actions occur on rainy days, it is highly probable that the function demands the influence of the sun's rays, or at least good diffused light.

What is the nature of this ozone-producing process? might be pertinently asked. Without stopping to discuss lengthily the question, it may be stated that all the results of our investigations point strongly to the fact that the odoriferous principles emitted, whether from flower or foliage, are chiefly concerned in its formation. It is to the various vegetable perfumes then that we must attribute a purifying and healthful influence upon our atmosphere, rendering it suitable for the purpose of human respiration. And if it is true that ozone is generated by odorous foliage and all flowering species, the signal importance to public health of a proper ratio of distribution of forest growth is obviously apparent.

Our researches have shown that the exhalations from the coniferæ evince marked energy in developing ozone, a fact to which we cannot attach too great importance. Fortunately, the resinous species are easily continued, if we can secure certain favorable conditions of soil and climate. It is to be hoped that a knowledge of the fact that pine forests furnish in abundance that depurating material ozone to our atmosphere, will cause more attention to be bestowed upon their cultivation in the future than has been done in the past.

In a paper† read before the American Climatological Association (1886), Prof. A. L. Loomis, after citing authorities to show that our pine forests contain both ozone and peroxide of hydrogen, justly argues that these bodies render the atmosphere not only aseptic, but also anti-septic, and he attributes the benefits to consumptives from a residence among the pines to these atmospheric elements.

The ozone generating function being to a less degree under the control of the temperature than the direct rays of the sun, it follows as a natural corollary that flowering vegetation and odorous foliage are everywhere engaged in the noble work of atmospheric purification, if we except periods of stormy weather. We may also discern an all-wise purpose, for which our numberless species of wild flowers, universally present, even occupying the most obscure places on the face of the earth, are designed by a kind Providence.

Again we now recognize why plants in one or another quarter of the globe are in bloom not only every day of the year but also well-nigh every hour in the day.

In the elegant language of the famous botanist to your Board, Mr. Meehan, we have "morning glories that welcome the rising of the sun; chicories, dandelions and others that wait for the rising until after breakfast. Some like portulaccas, oppuntias and night-blooming cereus, with other plants, attend on the students who burn the midnight oil."

Reasoning from the beneficial results of the two vegetable functions, transpiration and the production of ozone, it may be safely concluded that forests exercise a potent favorable influence upon the salubrity and healthfulness of a region, and the notion—by no means modern—that the woodland air is highly invigorating, receives decisive confirmation. Now, the wisdom of the maintenance of a fair ratio of forest growth has from no other quarter received stronger support than is afforded by their climatic and sanitary advantages. It

† See Philadelphia Medical Times, July 23, 1887.



should be stated that there is no other question for whose solution an enlightened public sentiment is more definitely valuable than the one under discussion. It would be well to stop here and inquire for a moment, what is the present condition of the climate of Pennsylvania? Is her climate becoming more variable both as to humidity and temperature? If the latter query, as many observers contend, is to be answered affirmatively, can the deterioration of climate be ascribed to the disappearance of the forests?

We have in Pennsylvania about twenty-five per centum of timberland; not a bad proportion to the total area, though unfortunately, in many instances, our forests, owing to their present painfully neglected condition, are practically useless so far as any favorable influences upon the climate is concerned. And from our present positive knowledge of the condition of the forest air it is quite safe to assume that the climate of Pennsylvania might, to some extent at least, be improved by proper attention to the administration of her forests.

(6). The Advantages of the Climatic Influences of Forests in the Presence of Health Stations.

The hygienic uses of house plants, both as preventatives and as remedial agents during the progress of certain diseases, have been shown elsewhere, and it is but natural to expect that forests hold out the same chances of relief to invalids in search of renewed life and vigor. In the treatment of acute and chronic forms of laryngitis and bronchitis, a locality having a proper per centum of forest trees rightly located would be quite effective during the period of vegetable growth, provided that the temperature be tolerable.

For the treatment of such cases the highly ozonized atmosphere of the pine groves would, perhaps, be preferable, more especially in cases of bronchorrhœa, in which a comparatively dry atmosphere would at least accomplish the greatest degree of comfort, if a cure be out of the question.

In estimating the value of the wilderness air in these cases, we should not lose sight of the one supreme advantage of the changed and purified air of the forest, namely, its continual local action on the diseased mucous membrane. The climatic requisites for the consumptive invalid are, by all writers, considered to be a dryness, equability and pureness. Of these, none, in my opinion, is of more importance than the latter, namely, purity. And from the facts demonstrated by previous researches into the functions, transpiration and the generation of ozone, it may be inferred that we have here the conditions most favorable to atmospheric purification. Doubtless, much of the benefit derived by patients at high altitudes is ascribable to the greater purity of the atmosphere there than at lower levels. Forests, as before shown, also favor greatly the quality of equability both as to temperature and relative humidity.

How they intercept and temper the bleak winds of winter in cold altitudes, and how, by their shade and their surfaces, they have a cooling affect on the temperature in summer, has already been explained, and in this connection the importance of these influences is to be especially noted.

They should be favorably situated with respect to the prevailing winds more especially in marshy localities which are known to cause malaria frequently. With respect to the degree of moisture in the climate-management of phthisia there is great diversity of opinion

though undeniably a majority of the best authorities have pronounced in favor of dry climates.

The subject of public breathing places or open squares has of late attracted the attention of scientific men and is one of the utmost public importance.

The following remarks upon the sanitary aspect of this question, though at various times in the past urged upon the attention of the public by the speaker, are, with your permission, again stated.

"Since our city parks and public squares may be regarded as forests of reduced size, it will appear obvious that they are also capable of valuable hygienic influences. It must be confessed that nowhere could trees and ornamental shrubbery prove their virtues to greater advantage to the public health than by improving the conditions of a vitiated city atmosphere. As in the case of forests, so the action of public grounds must needs be of a local character; hence it is quite obvious that in large cities quite a number of squares of the ordinary size would be needed to produce the desired effect. The conclusions respecting the influence of forests upon local climate apply, with few exceptions of little importance, in the present instance. For obvious reasons, their effect in mitigating the extremes of temperature by checking the force of wind currents is here almost negative, but the trees, by causing refreshing shade and transpiring aqueous vapor, have a delightful cooling effect, thus tending to moderate the oppressive mid-summer heat of our large cities. Along with the moist vapors constantly emitted there are also other health-giving principles evolved, and among them ozone is the most important. Since only flowering plants and odoriferous foliage are ozone-generating, the vegetation of these public parks should be selected with due regard to this fact. The same percentage of the total area should be assigned for retreats of this kind as is usually considered to be the proper ratio of woodland for ordinary sanitary purposes, namely, twenty-five. But what city can boast of the needed percentage of forest area?

To secure this happy ratio would be impossible in those portions of older cities already densely built up but even here an approach to the proper standard might be attained by the more general planting of trees on either side of the thoroughfares. This latter suggestion if carried out would have the effect of improving the air of our streets which is already the air we breathe, and thus, by means of free ventilation, the pure, wholesome atmosphere would be admitted into our dwellings.

It is quite evident that by providing sufficient reservations of this sort a perfect boon would be conferred upon that large element of our population, the humbler classes who, for financial reasons, are unable to make a change of residence during the heated term.

Again, such squares form a convenient substitute for a more complete change of air in the case of a large class of patients suffering from the infantile diseases of summer. In all medical knowledge there is no fact better established than that the usual summer ailments of infants can be most successfully treated by change of air.

Than the subject of open squares and their maintenance under proper regulations, there is none more important inviting the attention of our municipal law makers, and it is no exaggeration to say that any improvements they might make in this regard, would be rewarded by a realizing sense of having done the greatest good to the greatest number.



# THE MOUNTAIN REGION OF CENTRAL PENNSYLVANIA, AND ITS RELATION TO FORESTRY.

By Prof. W. A. BUCKHOUT, *Entomologist of the Board.*

Central Pennsylvania physiographically should comprise all that part of the State between the curving east front of the Allegheny range proper on the west, and the Blue Ridge on the east. These two boundary lines run nearly parallel to one another, but curve so much to the east in the north Susquehanna region that they include a considerable part of what is geographically the eastern part of the State. This large curving band is fairly distinct from the plateau region on the west and the Great Valley and South Mountain region on the east. For my present purpose, however, I prefer to consider only that part of it which lies between the Allegheny Ridge and the Susquehanna and Juniata rivers.

I know this portion better, and it is so uniform in character that we can arrive at more definite conclusions from its consideration alone. It is a region of alternate mountain ridges and valleys, the former made up chiefly of rough sandstones, the latter, when large, of the lower silurian limestones, flanking which, and sometimes making a part of the mountain slopes, is a band of shale, the latter often making the floor of the smaller valleys or plateaus, regions for the most part, are only spasmodically cultivated. The underlying rock strata are nowhere horizontal, but are variously inclined, often at a high angle; and this, together with differences in the composition of strata, has determined great inequalities in the erosion or wear, and we find many cases of sharp, sudden passages from one kind of rock to another, and the rapid wear of some beds has left the more resistant ones as ridges, from which masses of rock have fallen from time to time and covered the slopes below.

The rainfall over this area is probably about thirty-one inches per year, and its altitude from eight to fifteen hundred feet. Originally the whole was thickly wooded. Tradition speaks of treeless districts, but they were probably limited in size as well as in time. Settlements naturally took up the limestone valley land, and later such other as was suitable for cultivation. So that, broadly speaking, there were two kinds of land. Valley land which was chiefly cultivated, and mountain land which was uncultivated and in forest. This distinction still remains, only more intensified, probably never before has so much of the valley land been under cultivation, nor so much of the mountain land forest, or rather perhaps waste land, since much of it has been culled over and then abandoned to nature. Assuming then that time has demonstrated the value of the one for continuous cultivation and the other as of no value for this purpose, we may drop any further consideration of the former and turn our attention to the latter.

The problem then is what is the condition and character of these mountain lands, and what can be done with them. Roughly speaking they comprise one-third of the surface under consideration. They vary from the steep slopes, covered by huge angular blocks of sandstone, to the "benches" and "kettles" of gravelly or shaly, thin and rather poor soil. They are covered in some places by a growth of good timber preserved by reason of its inaccessibility, in others by a hap-haz-

ard, irregular second growth of limited value, in still others the blackened tree trunks show but too plainly the fearful ravages made by forest fires, and the small encouragement which there is to attempt to prevent them under present conditions. Lumbering, in some one or more of its different forms, is carried on wherever it can be done at a profit. New methods of working and new demands have made feasible and profitable the use of much material, which half a century ago would have been left to rot or burn. Nevertheless the percentage of waste is still large, inordinately large from the stand point of an outsider, who is astonished at every turn to see the amount which is cast aside. The sole reason for this is, that it will not pay to handle it. The cheapness of coal, its superior value and greater ease of handling, make unprofitable the utilization of this residue any further than is done. Slowly, but steadily, the useable timber is being removed from this whole district. What then is to become of it? Unlike the valley region, it is not susceptible to cultivation. Even where this is possible, it ought to be discouraged for two reasons. First, because there is an abundance of other land on which a man can make a better living, and, second, because this is much better adapted to forestry than to anything else. The attempts heretofore made at cultivation have been spasmodic and generally ended in partial, if not complete abandonment, as changed conditions have rendered unprofitable many of the small hand industries, with which the pioneers eked out a subsistence half a century ago. Its capacity for forestry has never received any attention whatever. It seems to be generally assumed by lumbermen and land owners that there is nothing to do but make the most of what can be stripped from it, then abandon it to nature, and let it take care of itself. Suppose that this region is to be reforested, how is it to be done? and to what advantage? It may be done naturally or by artificial means, or by a combination of the two. Natural reforestation will generally take place over any recently cleared wood land in time; but it is liable to be unequal in respect of the number of trees on a given surface and of the varieties produced, and to require a long time. In order to make the best growth, trees should start close together and cover the ground thickly. They thus protect the ground from undue wear, and the struggle for existence causes them to grow straight and tall. A great difficulty with this natural method alone is, that for several reasons this second growth is not dense enough and starts unequally. The older trees thus get the advantage and keep down others. The result is a small number of very strong, but rather bushy-topped trees interspersed with younger growth, which is kept weak and straggling by the overshadowing of the others. Moreover the second growth is generally of different species from the first and often of undesirable species. This, which has been sagely observed as nature's law, is due solely to the fact that certain seeds get in ahead of others, and the young trees are strong enough to keep the lead thus gained, and not to an exhaustion of the soil which makes it impossible for the same kind to make a second forest. There is no foundation for the popular idea that a hard-wood forest must follow a pine. The character of the succession may be complicated by the action of fire, which, however, seriously affects all attempts at reforestation. The natural method is much more successful in regions north of this, particularly in localities where maples and beeches are common trees, since they furnish seeds which are easily disseminated and quick to germinate. In order to get as large a number of trees as



possible upon a given surface, and those kinds which are most valuable, it will ordinarily be necessary to aid nature somewhat. Complete reforestation by artificial planting of either seeds or young trees would in this case be a tedious and expensive process. I know of no instance in which it has been tried on a large scale except where the conditions were very different from those here considered. On the virgin lands of the west, and some sandy, easily-worked regions on the sea coast, artificial planting has been undertaken, and has been successful. It has been demonstrated that trees can be raised on good land just as well as any other crop, provided due care and attention are given them. This can probably be done in Pennsylvania as well, but that it can be done profitably on our average farming land I do not believe. The cheap lands of the west and the sand wastes of the coast may be so used, but it would be useless for us to attempt it, the more so since we have so large an area of this mountain land, which can scarcely be used for anything except forest, and we ought to bend all our efforts toward making it as productive and valuable for forest purposes as it is possible to do. Since so little has been done toward artificial reforestation such a district, we must look to experiment to show us the most feasible and inexpensive method of getting a close stand of desirable trees. This problem should be worked out by actual trial on the ground. It will cost something, and some trials will be failures, but there are good reasons for believing that it can be done, and at a moderate cost. The great difficulty will be at the start, and in adopting the methods employed to the local peculiarities. These lands vary, as stated, from those having a fine compact soil to such as are covered by huge fallen rocks, and no one method will answer for them all. If the former are not already supporting some tree growth they could be rudely broken up by ploughing occasional furrows in which the seedling trees could be planted, or the seeds if they are used could find a foothold. This is the method which has been employed in the plantations on the sea coast, and it answered the purpose. Where, however, there is already some tree growth, or the ground stony or obstructed, the preparation must needs be done by hand—to our minds an exceedingly slow process. But if the desired end can be attained, *i. e.*, the uniform stand of young trees, we ought not to be deterred on this account. Once well done it is done for a long time. It will be many years before it need be repeated. The use of the gravelly and stony-surfaced parts will depend somewhat upon their situation, exposure and moisture. When they have been stripped of their tree covering and fire has swept over them and destroyed the smaller growth, leaving nothing but the stones themselves, they present the most forbidding aspect. One would say that they could never be made to support any vegetable growth, small or large. But watch them for a time. They soon show signs of plant life here and there, wherever there are hollows in which moisture, dust and leaves collect. A coating of lichens and mosses follows. Then flowering plants, brambles and scrubby species. Lastly, tree seedlings appear, sometimes quite thickly, and though they do not grow so rapidly, nor acquire so large a size as those with more congenial surroundings, yet they often make very fair trees. The secret of this lies in the fact that these loose rocks have fallen from a higher level where they have been undermined. Such a rock-strewn surface is not a correct index of what is beneath. In places where excavation has been made there are often found several feet of loose gravel

and earth covered and concealed by the large rock boulders. If the roots once get well fixed in this underlying gravelly soil they can support the growing trees provided there is sufficient moisture. The proof of this may be found at various places, and frequently a good growth of timber exists or has existed where the surface when examined is found of the character described. Sooner or later fire goes over such places after the track of the lumberman every few years, and this fully accounts for their utterly desolate appearance. All stages of such forest growth, decay and repair, can be seen at various places in the Seven mountain of Center and Mifflin counties, and much of the horribly desolate, rock-tumbled higher slopes once bore a thrifty forest. Fire destroyed it. This opened the way to, and left unhindered, the destructive action of water and air. Recuperation, under such conditions, was necessarily spasmodic and imperfect. Some parts are apparently irreclaimable. The process has gone so far that it seems entirely useless to try and do anything until nature has worked over them for a century or two herself; but with others, not so bad. I believe that acting on the hints obtained by this natural reforestation we may be able to accomplish much by planting seedling trees and seeds in whatever places are suitable. I do not suppose that this suggestion will meet with much favor among practical men. The planting of forest trees seems to most persons a chimerical project. Look at the time involved, the prices of timber and the great quantities yet untouched! These ideas are so firmly rooted in the minds of people that it is not easy to convince them of the need or feasibility of it. Moreover, as a people, we are still influenced by the idea that we have boundless resources; that if one thing fails us another can be put in its place, and that we cannot afford to invest our labor and our means in any project which will not yield a speedy return. Some individuals of means and energy may be willing to make a trial, if the way can be made plain to them, and I look to our experiment stations to do this. These newly established aids to scientific agriculture are just now getting a good deal of gratuitous advice as to the nature and scope of their work, and I make bold to suggest that the claims of forestry ought not to be ignored. There is some popular interest in this subject and nothing would so conclusively show the great value which this mountain region may yet be to us, as the attempt to clothe these waste lands anew with trees, utilizing them for the purpose to which they are naturally best adapted. It would not involve great expense, even should it prove unsuccessful, and although many years are necessary to produce trees of usable size, a few years only would show whether or not certain methods would give the stand of trees which it is necessary to secure. Let us select a spot which will give fair average conditions. Let us try the sowing of seeds, if on due examination that should prove feasible, plant directly if any parts should seem to be adapted to that method and aid the sprout growth by occasional additions where it is scant, and by thinning where it is too thick. The particular kind of trees to be used would depend in great measure upon the condition of the surface, but it is probable that place could be found for all those which we esteem of most value. Seeds and seedlings of almost all our trees can now be had at a surprisingly low price. If these trials should prove impracticable for people in general, because of the expense incurred or other reasons, then we must fall back on natural reforestation, uncertain and unsatisfactory as that may appear. The success of the natural process would be more



nearly assured if owners and lumbermen could be induced to have some regard to the future of these lands and to regulate their methods accordingly. The indiscriminate cutting of large tracts at once exposes them to danger from several sources, prevents or retards the natural seeding which ought to take place, and in general is unfavorable to easy reforestation. Of the contingencies to guard against that which is of the greatest effect, and, unfortunately, the most difficult to manage, is the forest fire. What this amounts to I need not occupy the time to rehearse since it has been done so often. Suffice it to say that what fire is to property in houses, factories and buildings of various kinds it is to forest property—with this difference that relatively it is a more frequent danger to the latter than to the former, and a more destructive one because of the lack of any efficient watchguards or means for prevention or control. It is to-day the most serious drawback to any plan for improvement in forest management. The man of business says in effect what guaranty have I that if I sow and plant the forest fire will not reap? and we are obliged to answer none. For, though we have laws on the subject, they are notoriously insufficient to meet the conditions in the case. It seems to me that nothing short of a system of patrol or forest wardens will meet these conditions. Within such a district as this under consideration a system could be established to be in active operation only during such part of the year as rendered it necessary, during the rest of the time to be subject to the call and direction of a responsible chief. This may seem to be adding to the machinery and expense of government, but is there not the same need for the protection of property in forests as of property in any other form? There are further some incidental advantages in making this mountain region one of forests, and they should not be lost sight of. There has been, for a long time, an impression that forests exert some sort of an influence on climate, but what that influence is has never been distinctly known. Some extravagant claims have been made which have no warrant in scientific demonstration. But the mechanical protection afforded by them is undoubted, and in respect of their effect in holding back snow and water, and thus regulating the flow of streams, they serve a purpose which cannot be performed by anything else. Snow is more uniformly distributed in a wooded region and resists melting longer, particularly during times of thawing in midwinter, which frequently carry off all the snow upon open ground. In one respect the regulation of the water supply here is somewhat different from what it is in other places.

We find that the drainage is largely underground, for flowing out of this mountain district are comparatively few and small streams, and many of these sink shortly after they reach the valley to reappear again farther on in the great springs so characteristic of the thick limestone formations through which their waters have passed. Underground drainage, however, begins in the mountains themselves. Let the mountains become barren wastes of rock, and the water will not only run from their slopes as from a roof, but the underground streams and springs will fluctuate to such an extent as to make them an unsatisfactory dependence. The old saying has it "the mill does not grind with the water which has passed," and if our mountains are richly covered with growing trees these latter will abstract from the falling rain and the percolating waters sufficient for their needs and wrest a first service which the uncovered lands could not exact. To use to the fullest extent the forces and products of nature is wherein

the civilized man is distinguished from the barbarian. One by one the forces of nature have been harnessed and made to serve our bidding. Our water supply should yield its toll likewise, the sooner the better, and the greater will be the gain. I will not longer trespass upon the time to set forth the general needs and advantages of forestry. They have been written upon so many times and so well by others that it is unnecessary to repeat. Rather let me summarize briefly their reference and application to the locality under our consideration. I have endeavored to show that the natural adaptability of the ridges and smaller mountain valleys of Central Pennsylvania to forest production is so great that effort should be made to keep them continuously for this purpose. That their cultivation should be discouraged as unprofitable compared with other lands, and that so soon as they become cleared of their natural timber effort should be made either to protect and add to the new growth or to seed and plant directly for this purpose. That the interests at stake are of such importance as to warrant trial and experiment of the methods best fitted for such work. That for protection we need some efficient legislation to reduce the great risk from fire, and that this is so important to success in forestry that if necessary a system of partial patrol or watching should be undertaken, even though it would require some expense in the maintenance, the more so since the incidental advantages of keeping this region forest-clad are very great, and directly affect the prosperity of all our people. And lastly, albeit it may be considered but a sentimental consideration, a just pride should constrain us to use the trust which Providence has committed to us without abusing them, and to hand them over to our successors unimpaired. This is a test of the highest civilization, lack of it marks the barbarian.

#### THE WORK OF THE PENNSYLVANIA FORESTRY ASSOCIATION.

By Prof. J. T. ROTHROCK, *Philadelphia, Pa.*

Forestry in this State, as, indeed, in all of our States, may be regarded as of very recent origin; so recent that we are yet in the period of agitation rather than of action. Yet so much of the former has been done that the latter is sure to come, and with its advent the first era in the history of this movement (which in the Western world is so new and in the Eastern so old) may be regarded as closed. The future will show no discussions as to whether forestry is needed here, but will be full of discussion as to the best methods of obtaining its largest benefits to the individual, the Commonwealth and the country at large.

Before, however, we introduce the new era, it were well to consider the steps by which its appearance has been hastened. There are few characters, except those who are, in themselves, or in their principles, actually bad but have some positive use. Even the alarmist has his uses. The remote danger, in his eyes, is a present menace. But still he sounds his note of warning. So it was in the case of those who were the first to call attention to the too rapid disappearance of our forests, and to the total lack of measures for their renewal. It was a thankless task, which only those who succeed us will place a



proper estimate upon. They, at least, rendered a public service by contrasting our wasteful methods with more prudent customs, which characterize other civilized lands, and so familiarized us with forest laws and forest systems of restruction to which we are now so fast coming.

There is this to be said in behalf of early and constant agitation of this forestry movement—that years must elapse after active measures for forest restoration are undertaken before there can be shown any considerable results. Meanwhile, the need which started the movement is becoming all the time the more urgent; and, indeed, this need may culminate in serious destitution before help comes.

One outgrowth of this threatening condition of affairs has been the Pennsylvania Forestry Association. It may appear strange that it should have been first formed in your largest city; yet it is in cities that such movements usually do originate, because those men actively engaged in business detect most quickly the unhealthy relations which may exist between supply and demand and, also, because there, from the larger aggregation of individuals, interchange of opinion is most easy and organization most promptly effected.

It is but just to say that in this case not only were the initiatory steps taken by ladies, but that the most constant and active workers in this cause are yet ladies—ladies whose names I should be glad to mention here if I had their permission. The first public meeting was held in the winter of 1886. As a result there were fifty members enrolled. They were mainly from in and near Philadelphia. Since this time our membership has quadrupled; several branch societies have been formed, and influential names from all over the State added to the organization. Surely this outlook is encouraging enough.

So much for the past! What for the future? The first thought is formation of public sentiment in favor not only of the preservation of our forest resources, but of all the resources of the soil, as well as increase in the yield of all that springs out of the earth. Here, then, is a broad basis on which these two organizations, the agricultural societies and the forestry associations, may, and should, prove mutually helpful. Between them there should be the closest possible union. It is hard to comprehend how any cross purposes should ever arise between them. Yet, on the other hand, each has a specific work to do.

It is true that "the forest waters the farm," and hence the fraternity of feeling between these organizations should be as perpetual as this relationship. It is also true that most of the land on which the forestry of the future will earn its most signal triumph is not now, nor ever can be, called agricultural or farm land. Hence, then, the justification for the perpetuation of both forestry and agricultural societies. It would appear that the surest bond for the greatest prospective benefit would be a large number having membership in both societies. There is another idea; that as *occasion offered* there should be joint meetings, such as took place in Philadelphia between the American Association for the Advancement of Science and the British Association. A still more promising plan, because it would invite more frequent, freer interchange of ideas, would be the organization in each county of branch forestry associations whose meetings could be held at least once a year at the same time and place as your own county meetings, where essays upon the mutual relations of forestry and agriculture could be read and discussed. And, also, where the plans of

each organization for the near future could be made known *so far as proper, and to the same degree*, active, mutual aid rendered. When we bear in mind the large interests which these causes represent, and the consequent legislation which has in the past and must, in the future, grow out of them, it would appear desirable that all related societies should be on such a basis as to command the largest legitimate influence in the promptest manner.

May I use the phrase, create public sentiment? If so, then I should say, this sentiment should be created and turned at once to work in several promising channels. First of all, we need a strong current to float the idea into every hamlet in this Commonwealth, that timber is useful for much else than production of lumber and firewood. That it has to do with the even flow of water, and, to a certain extent, with the health of the community, and that while the land owner does control the timber right, he should also be mindful of his relation to the State at large. And in this connection he should be fully aware that for whatever service his forest, retained as forests, render the Commonwealth, he should in some way be rewarded. If it is desirable to plant trees, then it is also desirable to protect trees already growing, against premature or wasteful destruction, and whatever premium the State has placed, or will place in tree planting, it should with greater reason offer to those who allow forests to stand. If forests can be shown to be requisite for public health and for regular supply of water in our streams and springs, then to tax forests which are not being converted into lumber, is to tax the owner for being a public benefactor. This is surely a new phase of political economy. Then there is another channel in which your influence might well turn a vigorous current, and wash out the old idea that one duty of a State is to get rid of its lands as soon as possible and then have no more to do with them than to receive the tax—whether it be much under good management, or little under bad management. All misuse of individual property which lessens its returns is, in one sense, a fraud against the State. It decreases revenue and so places a yet heavier burden on those who are already making the largest returns to the Commonwealth. Hence it would appear as if our societies might jointly urge the State to resume its control over lands too poor for farming and upon which after removal of the timber, the owner failed to pay his taxes. If it is desirable to guard the fountain head of the streams in the mountain regions of New York State by protecting the forests, or if some of the wisest men in the land thought it well to guard the sources of the Missouri by protecting the forests there, it might be well for us to entertain the idea here. At least let us think over the question, as to whether the State should not be the owner of the hundreds of square miles of mountain tops and mountain sides; that are now being denuded of trees and turned into waste lands, and once having acquired possession, to establish such a supervision as will make them nurseries of trees and distributors of water. But do not misunderstand me, I urge no ideas which will rob the individual of a farthing. All that the State takes, let it take in virtue of existing law; for all that it buys, let it pay a fair price.

This brings up another question: What should it buy? Only such land as cannot be made productive to the agriculturist, and that along our stream heads. I have in mind such an instance, where the only return yielded to two men and three horses, for two days of excessively hard work, with wear and tear of harness and wagon, was



seven dollars and a half. And to obtain even this it was necessary to remove the timber, leaving behind an open, poverty-stricken clearing too sandy and too rocky even for a good sheep pasture. Such a price rates the services of a man, a horse and harness and half the wagon, at about one dollar and eighty-seven cents a day; and he threw in beside seven and one-half good railroad ties, which it required a half century to produce on his land.

Let me ask, what was the value of such an estate to the individual? It barely supported him by removal of its timber. What would it be worth when the timber was gone?

But such lands, poor though they be, are of value to the State, for it outlasts generations of men and can well afford to (nay must) inaugurate conditions, which will be its own strength, and the people's blessing a century hence. To this we are coming. We ask you to turn your influence with ours in preparing the public mind to meet the question fairly when it has arisen.

Just here I must add a word of caution. I have said that our forests were distributors of water. I mean this and nothing more. It has not been proven that forests in this latitude increase rainfall, whatever they may do in the tropics. They only enable us to obtain larger and more constant returns from what does fall.

But it cannot be too strongly urged upon your associations and the Pennsylvania Forestry Association that they use their whole influence toward the appointment of a paid State Forestry Commission. Whilst there is legislation that is desirable at once, there is a larger body of forestry legislation which will be required in the near future, and for which we have, as yet, no proper basis. That commission should go into the woods and not into the legislative halls, to do its most important work. The quantity and character of timber yet standing in every part of our State should be brought as nearly as possible to an exact statement. The character of soil best adapted to the growth of each kind of tree, and the average rate of growth, or rate of production, should be known. The question even as to whether, in certain places, State aid might not be rendered to individuals for forest planting, is worthy of consideration; just as we now aid individuals in supporting normal schools for the public good. It should also be considered as to whether a full course of forestry lectures should not be given in our normal schools as one of the surest ways of reaching every future citizen of the State and teaching him what, as a landholder, he owes to the community. It might, in a simple way, do much work like that of the German forest schools. These are some of the problems which are practical in character and to the solution of which that commission should give its earnest attention. The work of the commission would grow. We cannot yet even enumerate into what useful channels its investigations might lead. But it should be a paid commission. A great State like this, which imposes its taxes on all its citizens, has no moral right, a decent right, to ask any conscientious, time-consuming labor as a gratuity from those who already discharge their legal obligation by payment of taxes just and unjust. But while the State should pay for such work, it should only employ competent men. The State is too heavy to allow such work to be given those whose only claim to recognition is that they belong to a dominant party. It is, above all things, important that conclusions reached and advice given should be after full, deliberate investigation.

It were better to have no legislation than hasty or ill-considered

legislation in this forestry cause. Mistakes made here involve not only an actual pecuniary loss, which is bad enough, but also a loss of time, which is worse.

### ARBOR DAY AND THE PUBLIC SCHOOLS.

By Dr. E. E. HIGBEE, *Superintendent of Public Instruction.*

*Mr. President, Ladies and Gentlemen:* I must ask your indulgence for not having written a paper. I have been asked to read a paper, but I have written so much upon the subject in the *School Journal*, and upon Arbor Day, that I think I can communicate my thoughts to you without having anything on paper.

I found in the first endeavor to secure Arbor Day in the schools a great objection among the directors, and also among the teachers. They thought in Pennsylvania we did not need anything of that kind, although they had it in Nebraska and other Western States. I did not dare to carry out any project until I had awakened a public sentiment. I therefore used the *School Journal* for years before I attempted to take up the subject practically. The first object I had in view was the benefit to be derived by the schools themselves, for in all organized society, the great danger is that people will have more of the organization than the practical working without. Now with such a system there is a great degree of routine, and there must be. And you cannot get rid of it. There must be a curriculum.—there must be a fixed course, and certain text books, and fixed recitations, in order to carry on the system of our common schools. To accomplish anything outside, you must break in upon this rule every opportunity you have, break them away from it, and that is the benefit I think Arbor Day has, to take the children out of the schools and familiarize them with planting shade trees, shrubbery and plants, and the planting and fixing up of the lawn and the fixing up of the fencing. Also through the teachers they can become acquainted with the nature of training and gradually reach the judgment of a scientific mind. But not only that, I found that the danger in the schools all the while was just this: That while studying the text book became the chief or important thing, the contents the least important. So we are studying botany from the text books, studying natural science from the text books in college. I thought that Arbor Day would serve the purpose of enabling children to go and see for themselves and handle. What a benefit for the children to learn that the white pine has five needles in the bunch and the yellow pine three, and the Austrian pine two; what a benefit to begin with in the order of classification, not to see with the carnal eyes simply, but with heightened intelligence awakening to the scientific mind.

Another object I had, viz: To get rid of the idea that these schools are State machines, for as soon as schools are made State machines, that moment they will begin to fail. They are related to the State, not immediately, but they are related most immediately to the family. School day, Governor, when it commences, is a regular festival throughout the whole family life of this Commonwealth. A week



before the opening it begins to stir up the children, and stirs up the whole family life. It belongs to the homestead, and belongs to the hearthstone.

But what can Arbor Day do? Why, it can bring the home and the school nearer together, so that our school houses would not look like barrens or work-shops, things to keep children in until they had completed their tasks, and then letting them go home again, things to bring the schools and homes nearer together. And what are our homes? There is the yard, the shade tree and the shrubbery; there is the lawn, with the lily, the morning glory and the rose, with the tree and its blossom; and when you go inside, the decorations, the curtains, the engravings and all that. And what power that has over our lives, imperceptible, it is true, when we are young, but subsequently it has its power. Years afterward we go to our homes. The father is dead, and mother is dead, and the hearthstone is desolate; but there is not a bramble, or vine, or tree, or particle of shrubbery, but as soon as it catches the eye thrills the soul, for it was the old homestead.

What I wanted was that our school houses should be of like character, not unfenced, not yardless, not grassless, not treeless, not flowerless, not mere barracks lying as a piece of fresh beef on a board, but that they should have fine shrubbery and lawns. And not only this, I wanted the reactionary benefit upon the children themselves.

And now in regard to forestry, the prime object was this: How can you accomplish anything until the common mind is aroused? How can you expect to take the farmers and dwellers upon our hillsides and in our valleys, and influence them upon the subject of forestry by scientific presentation simply? You cannot do it. They do not understand your terms. The very articles you have read here, valuable as they are, there is not one farmer out of five thousand that will understand the terms, much less the inference. What must you do? You must strike the home life of our people. And are we not doing it when we are arousing twenty-five thousand teachers to talk about a subject and speak of it in every form and holding it up before the children? Are we not doing it when we are influencing almost one million of children to think of the value of trees, to become familiar with them and finally gathering a love for them? That is what Arbor Day is doing. It cannot accomplish anything so far as timber is concerned. But we have planted I suppose something like three hundred thousand trees. Many localities have already been taken up with fruit and other trees, and we are beginning to take up your highways, but schools cannot protect your forests. But they can do this, they can raise up a generation that will not leave our mountains treeless, they can raise up a generation that will rebuke the wanton destruction of forests, not only on the side of commerce, but on the side of beauty, the æsthetic element, which has wonderful power upon the social world. Allow me to say, therefore, that Arbor Day, instead of being rebuked by the schools, is encouraged, and more will be done next year than before. If you will only give us room, we will shade your road-sides all over the State. If you will make parks we will fill them full of trees of all kinds. If you will give us the opportunity, we will give you a net work of shade trees, and flowering shrubbery all over the State, and before ten years are over. (Applause.)

Governor BEAVER. The whole subject of forestry, viewed by the different standards, and the different speakers, and from every standpoint taken by any lady or gentleman, is now open for discussion. It is a general discussion, in which all are invited to participate; and we hope all the time will be taken up with short, crisp talks upon the subject. Dr. Higbee did not refer to the fact that we had two arbor days during the past year,—one in the spring, which was announced by public proclamation, in accordance with a joint resolution of our General Assembly, and another more especially for the public schools, announced in the autumn by our Superintendent of Public Instruction,—and it was a very delightful thing in my opinion, as you fixed the time for the observance on my birthday.

Dr. E. E. HIGBEE. There were something over 50,000 trees planted that day.

Governor BEAVER. Before we pass from the subject of Arbor Day, permit me to say that one man, who is "crazy" on this subject, in a given county, can do more than the Executive of the Commonwealth or the Superintendent of Public Instruction, in awakening an interest among the people and among the children in that county,—he can reach the papers, the county superintendent, and the superintendents of instruction in our boroughs and large towns in the several counties. One man who is wide awake upon the subject in each county is just what is needed, and gives more emphasis and more practical direction to Arbor Day than any other one in the State. The Doctor is connected with public instruction in our counties, and also reaches the superintendents in cities and large towns, and has a large influence. But the danger is that it will be confined to the schools. The people of every community should turn out on Arbor Day and assist in this work. Every man in the community should be down on his knees planting trees,—and that is what should be in every part of Pennsylvania, Philadelphia not excepted. All the members of the Pennsylvania Forestry Association should be in our parks on Arbor Day engaged in this work on their knees. That is the proper way,—not only the best position to take at that time, but necessary; because you cannot spread the roots unless you do get down on your knees. Then, too, the soil that belongs around the roots can be put in its proper place. Why, at the centennial of the settlement of Susquehanna county, where they asked me to plant a tree, and I took off my cuffs and got down on my knee and planted the tree, they expressed a great deal of astonishment. How else? You ought to handle a tender tree as you would handle a baby just newly born, and as if there was life in the tree. If you could induce a feeling of that kind in every mind, and all would give a few hours of their time to the two arbor days, Nebraska would not be ahead of us in the number of trees that we would have planted in the spring and autumn. If this State Board of Agriculture would take that step in advance in the minds which are represented here, you would see a new development all over the State on the subject,—not perhaps in the reforestation of our mountain sides—not to the extent of planting great areas at once,—but you would have roadways beautified, and the plots around our many school-houses shaded, both in town and country, and you would have the neighborhoods of our towns increased in beauty to a very great extent by the increased area that would be covered by trees.

Now, this subject is open for discussion. Pardon me for digressing, because I am, you see, a little "crazy" on this subject myself. I



would be glad if we could wake up and make crazy on this subject men in every county.

Prof. D. WILSON, of Juniata. I would like to emphasize, in a few words, the sentiment of Dr. Higbee, so that trees will be planted and cultivated more generally. In order to emphasize this, I beg leave to relate an anecdote: In Centre county, not two miles from where Professor Buckhout resides this incident occurred. One blustery Sunday morning a gentleman residing not over two miles from the State College, observed a slender column of smoke ascending from near the base of Nittany mountain. Instead of going to church he mounted into a saddle, and got as near as he could to the scene of the smoke. When he arrived there he found a couple of boys engaged in trying to roast a rabbit. They were on his land. He scared the boys by telling them they were doing a very unlawful act. Instead of prosecuting them he gave them a moral talk.

If every man had that spirit of watchfulness over these matters it would be much easier to have these laws carried out. There is no use in having laws if we have not sentiment sufficient to enforce them. If every man had a timber tract like this gentleman it would also be a good thing to have the same vigilance and care. I like to see trees grow. But it is very disheartening to plant trees, or have them planted along the roadside, and then have some mischievous boy, or to have cows come along and injure them to such an extent that they are useless.

Governor BEAVER. Plant them on the inside of the fence and do not turn your cows out.

Hon. A. O. HESTER. If the president of this Board (Governor Beaver) will stop the first time he rides up the river bank I shall be glad to show him a number of trees planted on his birthday, and he can keep his eye on them and watch their growth for several years to come.

In listening to Professor Rothrock's remarks in regard to the resuscitation of trees along the sides of mountains that are entirely unfit for agricultural purposes, it occurred to me that there would be no way better and cheaper than planting, or permitting to grow trees on these barren places, that they could be made valuable for wood hereafter, not by cutting down here and there, but by careful pruning. I have noticed in passing along mountains where the timber has been cut off that there was frequently a second growth of an entirely different character from the first,—that a great deal of that was underbrush. Now, the soil produces there a tree that is naturally adapted to the soil. Instead of going there and planting another tree let the one grow there which comes up naturally. Then, if the State would take charge of these mountains, and have some one go in and cut out the underbrush and trim up the trees that are growing, there would soon be a far more healthy condition of affairs. That, in my judgment, would be the cheapest, the best and the surest way of very soon acquiring what we desire,—that is, a new growth of trees on our mountain sides.

This matter of trimming has been perhaps more neglected in the United States than in any other portion of the world. One of my sons traveling in France a year or two ago observed a number of features different from our own. Upon his return I asked him if he noticed anything different over there from what he had seen in the United States. He said there was a great difference in the trimming

of trees; that there they were trimmed carefully, with two-thirds stalk and one-third top. In going over our land we notice that our trees are bushy, not fit for fire-wood, and very frequently unfit for posts and entirely wanting for timber because they have not been trimmed up. Now a man will trim an acre in one-tenth the time that he will plant new trees thereon. I think it would be well for us all to bear in mind this very important matter—not only on the mountain sides but on our road sides and on our farms. It would pay a great deal better to give more attention to the trimming of our trees than we now do.

M. W. OLIVER, of Crawford. I desire to ask Dr. Rothrock what percentage of timber they deem it desirable the lands of Pennsylvania should have? I ask this because the great trouble in our section of the State is to rid ourselves of our forest timber. I have no doubt that we have approached the danger line.

Prof. J. T. ROTHROCK. That is just one of the questions that I should like to see this Forestry Association give a definite answer upon. Now if I were to be obliged to answer, not exactly off-hand but to the best of my judgment, as far as I can fairly give, I should say twenty to thirty-five per cent.

Now this question of getting rid of timber. I have said I was raised in the woods, and more years ago than I care to tell. I was very active with others of my boyhood in cutting off white oak wood and getting our neighbors to come and work it together so we could burn it up—this in the wilds then of Mifflin county. We could not get rid of it in any other way. We wanted the land. We could not sell it. Three years ago I rode within a mile of that same place where I found one of my former friends and schoolmates had made some unfortunate business investment and became involved, and his land was in danger of passing into the sheriff's hands. He thought of some of this white oak land near the place where we had cut the white oak and burned it and he had put up a portable saw-mill; and the land was increased from being worth nothing to the saving of his land from going into the hands of the sheriff. Now it is a question whether this condition of affairs might not have occurred in some other parts of the State.

Dr. W. S. ROLAND, of York. The Professor spoke, if I understood him, relative to the percentage of barren land, or lands, that might be used for the cultivation of trees and not for any other purpose. I would like to learn from him what that percentage should be, from his calculation?

Before I sit down I desire to say that I, like the President of this Board, and perhaps a great many others, have become a little crazy on this forestry question, but I think it has somewhat worn off on my part and I am a little sorry for it. There is undoubtedly too much destruction of forest timber, and in such a way that it does no good to any person whatever, and we should encourage by every effort possible to keep up the cultivation of trees.

In regard to this subject of Arbor Day, it struck me that last year there were not so many trees planted, at least in my section, as there were the year previous. It has occurred to me also that if this question of Arbor Day were more thoroughly impressed upon the school children by their teachers telling them, "Now, boys and girls, Arbor Day is coming; prepare yourselves to plant trees and I will ask you the first session of school after Arbor Day if you have planted a tree and the kind." I think it would encourage them to give more atten-



tion to the subject. I think it would also gladden the heart of our Governor more on his birthday.

Dr. E. E. HIGBEE. A great many of our schools have no ground on which to plant trees. They have filled their yards now with trees and shrubbery, and they are asking the citizens of the various places if they may plant trees on the road-side. In York and Lancaster, if they will make parks and give permission to plant trees in them, and in our cities, we will give them all the trees they want within four years and they will cry stop.

N. F. UNDERWOOD of Wayne. I rise to answer in part the question asked by Professor Rothrock in regard to the increase in value of timber in other parts of the State. Now, I have been through the same experience that he speaks of. I have in my time in Wayne county helped to cut down and roll together and burn up a great many trees; and we did that because we had no other way of getting rid of them. I have lived to see a single hemlock tree—and helped to cut it myself—worth fifteen dollars standing, trees that in my recollection had no value whatever, and to day any tree in Wayne county that will make one thousand feet of lumber is worth six to seven dollars standing; and lumber is not very high there either. I think there are a great many counties in the State where, in the same time, the same rate of increase has taken place.

M. W. OLIVER of Crawford. Not so with us in the western part of the State. The Powell brothers had a tract of between three and four hundred acres, upon which they have recently disposed of the timber for thirteen dollars an acre. It is heavily covered with hemlock, beech, maple and some ash. Why have they disposed of that timber at that price? It is because they believe that the land stripped of its timber, seeded down with grass and used for pasturage, is going to pay them more money in the end than to grow timber. And that is just the reason why the farmers in the western and north-western part of the State have been clearing their land of its timber, so that they can use it for agricultural purposes. I believe, however, sir, that a certain portion of every farm, say twenty per cent., should be kept in forest. I do not believe that we should go to the other extreme, and have all our lands covered with timber. As farmers we can make more off our cleared land than by having it in timber. Hemlock with us is worth eight to ten dollars per thousand feet. We have trees from which we can get probably two thousand feet of lumber. Standing, that lumber is worth only about three dollars a thousand.

S. McCREARY of Lawrence. These portable saw mills have done more to destroy timber in our country than any other one thing. They move around from one section to another. If a man has twenty-five acres in timber out of a hundred, they will offer him forty, fifty or sixty dollars per acre. It is a temptation. The farmer is apt to think "if I had that land cleared I could use it for farming purposes, and it would bring me a revenue." I have a farm there with twenty per cent. in oak timber—so good they offered me seventy dollars an acre for twenty acres for the timber, and this not over a year ago. I did not sell it.

Governor BEAVER. Does there not come a time when timber begins to deteriorate?

S. McCREARY of Lawrence. Until that time, I think they will not get my consent.

R. S. SEARLE of Susquehanna. I spent a great deal of the younger part of my life in stripping timber off land. Did it ever occur to the gentlemen who are so urgent for us to retain our timber that a great majority of the trees from which we make our lumber come to maturity, die and fall upon the ground and encumber it, until a forest fire destroys it.

A gentleman of Susquehanna county, a tanner, had large tracts fall into his hands with most magnificent hemlock timber upon them; and it occurred to him to save that timber in making leather until it would be much more valuable. I was acting as agent for him in that county. We finally went over the ground, and we found a large majority of that timber had matured, and it was necessary to have it cut down to save from loss, and the bark taken from it. The lumber was sent down by the Susquehanna and sold to the railroad company; and the man who contracted for that work made enough to buy himself a good farm.

In our country the second growth is a hard maple; and almost always, when trees are cut off, there will spring up maples, beeches and ashes, and varieties of that kind will reseed themselves. But our burdens of taxation are so hard there that we leave but forty or fifty out of two hundred acres to grow timber on. To carry out your views, we have to bear a great burden, so great that we can hardly afford it. I for one have a good large field of about twenty acres, with about six years' growth of maple; they came up after a fire went through and the original trees were taken. They are very well sized, many being as large as your arm or your leg, this growth being of ten or twelve years. I desire to leave this for this second growth; but my neighbors and I also desire very much, in order that we may do so, to be relieved from a part of this burden of taxation.

S. McCREARY. We do not pay a large tax on timber land, in fact we hardly tax it.

Governor BEAVER. By cutting two or three trees that would otherwise die, the profit would pay the tax, and leave other trees to grow in their place.

Prof. J. T. ROTHROCK. It is plain to be seen where forestry is misunderstood. There is not a single advocate of forestry on this floor, or in this State, or in the wide world, who says plant trees when there is to be a loss, only plant them on ground that will not pay you better. For instance, there is the waste ground. I have been asked what the area was. I cannot at this moment recall my figures. I have gone over the State with some care, and, from recollection, I think I made it out clearly about fifteen hundred square miles—not miles square, but square miles,—of waste ground. I give this only as an approximate statement, I have the estimate somewhere.

Now with regard to the gentleman who spoke last. I fully appreciate every fact that he has stated here, that trees are just like animals, they reach their period of maturity, and then they decay and fall. I would assure him in the interest of forestry, and for every man interested in forestry to-day, that the subject is to be treated like the subject of live stock. As soon as a tree reaches a matured condition cut it down and get it out of the way, and plant another.

As to the question of taxes, that seems to be an open one. Nine years ago I urged, in connection with allowing trees to stand, that that land be exempt from taxation



Governor BEAVER. You run against the constitution there. You will have to advocate a bounty, or throw something around it.

Prof. J. T. ROTHROCK. That is a question that will always spring up. If there can be anything done, in ought to be done, and soon.

Governor BEAVER. It can be done in the way of bounty perhaps.

Prof. J. T. ROTHROCK. It seems to me that a man should be encouraged in some way in this direction.

B. E. FERNOW of Washington, D. C. I come from a country where all these questions I have heard discussed this morning were settled a hundred years ago. We do not discuss them any more, and therefore I feel a little uncomfortable when asked to speak on such questions. If you were to ask me how to plant a tree, or forest, I would be hardly capable of speaking, or as to what timber should be cut, and what left in forest; what soil should be taken for culture, or what soil should furnish it. Other questions I think will answer themselves in time. It is a question of development of the country. But that does not exclude the question of shall we now begin to consider intelligently how this delegation of one part of the soil to agriculture, and another part of the soil to forestry shall take place. Shall we leave it simply to nature and good fortune, or to accident? or shall we deliberately make up our minds that the deep soil is the first to be taken for agriculture, and maintain that all the stony, or shallow, or poor soil shall be turned over to another crop? I want to make this distinction on the aspect of forestry, as a matter of discussion for the soil culturist, if you please. We can raise a crop of timber, and that is what forestry is for. It is the foundation stone upon which we stand or fall. We, therefore, cut, not even when the timber is matured, but when the timber or wood brings the best price. I want to make that statement, because people talk against charcoal furnace operation. For instance "cutting down this timber, it is a shame! If they were left to grow one hundred years they would make good timber." A man is perfectly correct in cutting down any tree, even if less than twenty years old, if it brings him the most money. But what are you going to do with the land? Leave it raise a new crop? It seems to me to be a question that least occupies us, how shall we procure the next crop? Shall we leave it to nature and accident, or shall we do it intelligently?

Professor WILSON. There ought to be something said here in behalf of the lumbermen. Now the steam saw mill is devouring our forests in Pennsylvania very rapidly; and I have heard of some men who cut down the trees and leave nothing at all. I have in mind one instance where the wood land was cut away; but there happened to be plenty of seed on it, so that now there is a fine crop of young locusts about seven inches in diameter growing there. Any man traveling over the mountains of Pennsylvania will see locust trees growing in great profusion, and fine and hard, where the seed has been scattered by the birds or winds. Now some lumbermen say if you cut everything off, and sow with locust seed and beech seed, they will grow spontaneously without very much attention. Therefore lumbermen justify themselves in cutting down forests where the land is not likely to be used for agricultural purposes, by stating that the seed scattered there would grow up without artificial aid.

About a year ago I was on Shade Mountain, an ugly uninviting place. The principal timber was locust, where the birds had collected and scattered seed, and we find the best of locusts on the mountains.

So, as the gentleman has just remarked, after the place is cut down, and supplied with seed, it will grow to forest again.

Dr. J. M. ANDERS, of Philadelphia. Here is a query: "Dr. Anders stated that a tree gave off or distributed more moisture than the soil. Would this be his answer thereon?" I did say that a given area of forest growth would give off more moisture than a given area of open soil. I have gone over this ground carefully by experiment. A number of boxes containing a square foot of soil was used; and also a plant having one square foot of surface. The part over which the plant was growing was covered by means of oiled silk; so that all the evaporation must have occurred from the leaves of the stem. It was found the ratio, comparing the one with the other, was as one to five in favor of the plant. So with forest, there would be more moisture distributed, the leafy surface of the forest being so many times greater than the soil upon which it stands. You have more moisture from a forest than an equal area of open soil.

The next question asked is "Would the grass, weeds, &c., also distribute moisture?" to which of course I answer yes. Any soft green leaf will give off as much moisture as any other soft green leaf, no matter where found.

The last, or third question is, "Which gives off the largest amount of moisture, trees or grass?"

I have tested this question also, by taking a certain amount of grass of ordinary species, and comparing that with the evaporation of a given area of open soil. The grass evaporates on an equal surface a little more than from the open soil, showing that the soil is aided materially by the grass growing upon it. These are about all the questions that have been put.

H. W. KRATZ, of Montgomery. I am glad that I belong to this "crazy" gang too. I take it that on this question we should move as on all other questions, that is, we must educate the people, and have them know the usefulness and importance of tree culture, before we go into the details practically. We have a society in Montgomery county that is beginning to do a very good work. I take it that every county should organize a society of this kind, and visit the schools, my remarks are directed towards Arbor Day, and the planting of trees then. The other questions of course that have arisen here are equally important. And yet I believe the best way to carry it on in the future is to educate the youth of the land. We cannot do it better than by introducing the subject in the schools. The essay that was read this morning by the first speaker, Dr. Anders I believe, I think his production should be generally circulated, the others were very good, too, but that deals with the question in its sanitary light; and that after all it seems to me would impress upon the people perhaps the necessity of giving attention to this subject.

Now as to the progress that has been made since the introduction of Arbor Day, there can be no question. I can only talk for my own locality. Years ago I can remember there was a new school house built near me in a grove—a grove within a field—and instead of cutting the way through there to erect that building they cut the whole thing down, and cleared that away so there could be a school house. On driving by I wanted to know why they cut the trees away. The reply was that "there is no need of trees where there is a school house, 'you do not have school in summer time.'" "Do you never intend to have school then? You are only acting for the present."



Since the agitation of this subject they have planted trees around that school house, and beautiful trees they are, maple, chestnut and hickory, and just the trees that they should grow.

Now nearly all our yards are being fenced up. Not long ago they were open to the public; and with cows running at large it would have been useless to plant trees and shrubbery. But that day has gone by, and now the yards are full of trees, and I think they will remain so. My suggestion is that when Arbor Day arrives they appoint a committee of three or four to visit the neighbors and have permission to plant trees along the roadside. I think that is going to be carried out. That is the only means I know of by which they can be enabled to carry on tree planting. The yards are circumscribed, and they do not have a great deal of room; therefore, they can only do it by going out and planting in the neighborhood. We have beautiful trees along the Wissahickon. In driving from Collegeville to Zeiglersville, along the Perkiomen, the way is almost as romantic as the Wissahickon. We have other beautiful drives in the summer time, and other localities could be beautified in this way. Farmers in the most beautiful localities I have in mind in our county, seem to be progressive; they plant trees along the road and the turnpike, and they are not only viewed with delight by travelers over the road, but the trees give abundant shade to the cattle. Then they plant different kind of trees, not confining themselves to maple or evergreen, but planting such trees as will be useful for various purposes in the future. A gentleman purchased elsewhere a number of locust trees for posts. He had a sample locust post sent him that had been in the ground forty years, wholly sound. He has nearly his whole farm planted to that locust; and he has sold to other people who are buying because the wood lasts so long. This locust tree makes an excellent tree for shade and beauty, and, as I have said, answers remarkably well for posts.

Now, that is something we should advocate, such trees as can be utilized, not only one sort of fruit or shade trees, but different kinds of trees that can be utilized in different ways. I have a beautiful chestnut tree for my purpose, and a beautiful walnut, and if I had room I would plant other kinds. When the time comes for their decline, they can be used advantageously on the farm, if not sold, or they will make excellent fire wood.

My mind points to parents and to school directors. I believe some school directors need as much attention as the children. I visited a school some time ago and asked how many directors had been there, and how often they had visited the school. The answer was one, and only once. Last Arbor Day they agitated the question of planting trees. They gave the teacher and children no encouragement. Hence I say that it is important that not only the children should be educated in this work, but the school directors and the parents. When you have them all enthusiastic, that is when this work will go, and you can bring about the desired results. Whoever are interested in this matter should try to have associations formed in the various counties, and they can aid in the good work.

B. E. FERNOW of Washington, D. C. I ask gentlemen not to refuse or to be above the word "crank." No machinery is turned without cranks; and therefore if a man is a crank of this kind, he will be one of the wheels to set the machinery in motion, and to bring about the planting of shade trees more generally along our roads. I am just

about making a little sketch as to what is being done by the different societies in regard to agricultural interests, and I have written letters to the different secretaries. I have received one from your secretary, who stated that the "planting of shade trees is encouraged by law; but the result is unsatisfactory, because the roads get wet, and do not dry." I have incorporated that in my little sketch, and I want to define the position. I take it that this not the result of planting trees, but because the roadmaking is not good, no attention being paid to the drainage. Therefore you have to see that both of these matters are attended to—the planting of shade trees and the drainage—at the same time.

H. W. KRATZ. I take it that roadmaking is important as well as tree planting. There must be judgment exercised in the planting of trees as well as other things. I do not believe in planting trees too closely, but at such distances that the air can be circulated, and the traveler be charmed by them, as Judge Hiester remarked.

B. E. FERNOW. The gentleman intimated aright, that roadmaking in Pennsylvania is usually not too much over done.

H. W. KRATZ. Where they will not grow in roadmaking they will not grow in tree culture. Where they macadamize the roads, they plant trees along side.

J. B. SMITH of Luzerne. There is not a shade tree planted along the road near us. Do you not know that there was a law passed in 1879 allowing twenty-five cents for every shade tree planted along a road, a certain distance apart,—thirty-five or forty feet; and that that twenty-five cents was to go toward paying one-fourth of the road tax? If one planted more than the road tax amounted to, it would go to the next year. In my section, when I called attention to the fact, there was not a man who knew anything about that law. At that time they claimed that by its operation Pennsylvania would be beautified, and become a garden spot. The law was passed; but there has not been a tree planted in our county under it that I know of. If that subject were agitated in the newspapers throughout the State, and the farmers made to know there was such a statute, it would be of great use.

F. M. MCKEEHAN of Perry. My recollection is that the law makes provision that he who cuts that tree and uses it pays back a certain percentage to the county which raised it. However, in Perry county our supervisors have never planted many trees by the roadside.

Another thought, referred to by my friend, Judge Hiester, relative to the growth of trees on barrens. One fact I apprehend in regard to barrens is—those at least that have been denuded of their forestry—they unfortunately do not gather a second growth as readily as the first, so much of the timber is left upon the ground, utterly valueless to the party who owns it. The result is, if the timber is removed, this worthless timber stands. It detracts largely from the second growth, and therefore the second growth is not uniform and does not make the growth that it ought. If all could be cut off, so that the second growth would start equal, it would all have a better chance, and many of our hillsides would be thickly studded with a second growth of forest. It will not do unless some provision is made for a more uniform growth of the new forest.

There is no difficulty in regard to the planting of locusts. If the ground is turned over, the seed of the locust takes readily and rapidly in almost all our soils. I can show you trees that have been planted



within twenty years, from which one could make six or eight or ten posts. I think there is no tree that a farmer can make more money out of along the roadside if planted, or which will make him a more speedy return, than simply our common locust.

Dr. J. P. EDGE of Chester. I do not rise to discuss the general question further than to commend as best I can the excellent essays that we have listened to. They are certainly of a very high order. I would designate especially that of Dr. Anders', because of its relation to the sanitation of the people of the State.

But I feel like making a motion to give this discussion a practical bearing, as we have no formal question before the house. If my motion is seconded, I will not press a vote on it until the close of the afternoon session. The motion may seem a little premature at this stage of our discussion. I have no doubt that at the proper time you will recommend to the Legislature the need of legislation on this subject of forestry; but unfortunately recommendations of our Executives are not always responded to by the Legislature, unless a pretty strong sentiment comes from the people to back it. I think it is very important, therefore, that local organizations should be established in the different sections of the State—at least county organizations—either independent or in connection with the agricultural societies organized, that will urge an expression of public sentiment on this question.

Now in order to develop that kind of thing, it will be necessary for those who move in this direction to have the material with which to start up. As I do not know anything better that could be put into the hands of those who are interested in it than the papers we have heard to-day, and the discussions growing out of these essays, my motion is, without interfering with the duties of the secretary and the advisory committee of this Board, that they be requested to incorporate in the next quarterly report of the Board the essays and discussions had this day, so far as it may be in their power. With this mass of matter collected together, and the men in different parts of this State who are crazy on this question, or cranky, if you allow the expression, you can have an influence that amounts to something on the subject. A copy goes to each paper in this State, I think, by provision of law; and each member of the Board is furnished with a dozen fifteen copies. He can select in his county the men who will be most benefited in this direction by receiving this report. Now, with a little coöperation and a little care on the part of the members of this Board, public sentiment can be readily developed in advocacy of forestry.

Governor BEAVER. The act of 1879, which has been referred to, was approved on the second day of May of that year, and is as follows:

"That any person liable to road tax, who shall transplant to the side of the public highway, on his own premises, any fruit, shade trees or forest trees, of suitable size," but does not say who is to be the judge of the size, "shall be allowed by the supervisor of roads where roads run through or adjoin cultivated fields in abatement of his road tax, one dollar for every four trees set out; but no row of elms shall be placed nearer than seventy feet, no row of maples or other forest trees nearer than fifty feet, except locust, which may be set thirty feet apart, and no allowance, as before mentioned, shall be made, unless such trees shall have been set out the year previous to the demand for such abatement of tax, and are living and well protected from animals at the time of such demand.

"SECTION 2. Any trees transplanted to the side of the public highway as aforesaid in the place of trees which have died, shall be allowed for in the same manner and on the same conditions as in the preceding section.

"SECTION 3. No person shall be allowed an abatement of his highway tax as aforesaid more than one-quarter of his annual highway tax, and no one shall receive an abatement of tax for trees planted previous to the passage of this act.

"SECTION 4. Any person who shall cut down, kill or injure any living tree planted as aforesaid, shall pay to the supervisors of roads as aforesaid fifty cents for each and every tree cut down, killed or removed, to be collected as other road taxes are now collected."

Prof. D. WILSON of Juniata. I would like to ask Dr. Anders a question in regard to the Eucalyptus tree. It is said that that tree has been planted in the city of Rome in great number and has greatly helped the healthfulness of that city near the marshes. Now, is the planting of that tree attended by the relief mentioned?

Dr. J. M. ANDERS. Since malaria is the disease that is contended with there, and since the hardness of the soil, I should say it was due to absorption, or the absorption of the soil by the trees. Well, it is owing to the evaporation from the leaves that the water is taken from the soil, or the redundancy of moisture.

B. E. FERNOW. The monks around St. Peter's could not live there at all—the malaria is so bad around the campana at Rome that even the swine get sick and die. The subsoil is hard, volcanic tufa, and permits no moisture to go through it at all—it cannot evaporate. These monks have broken that soil with dynamite and planted the Eucalyptus. They have found them to have a decided effect in decreasing the malaria. You cannot go through that district after sundown without getting sick. It cannot be drained. There are no seams in volcanic tufa—the water stands there that should draw through the soil.

Governor BEAVER. A limited number of the pamphlets to which I have referred have been brought in, and I will be very glad to have them distributed. An additional number will be brought here later.

The questions which I propounded to Mr. Praetorius, "Will you give me the character of trees which will flourish on different kinds of soil?" "It is well known that locust will flourish on some soil and chestnut on other, and other trees elsewhere." "Will you give me the manner in which the spruce can be best raised, so as to provide for tree planting for the forest or along the roadside?" He has given a number of answers to two or three questions on this subject in this little pamphlet; and what he has said grows out of his own experience in tree planting and in the care of trees on the timber lands of the coal and iron companies belonging to the Philadelphia and Reading system. So I hope that the hints that will be given here will be productive of good throughout the Commonwealth.

Now, speaking of the trees which can be raised on different soils, we have not heard from our friend, Mr. Meehan. He has, I know, very practical ideas upon this subject of forestry. We also have with us this morning, not as a member of the Board but as a visitor, the new director of our experiment station in Pennsylvania, Professor Ormsby. We would be very glad to hear from them on the subject.

THOS. MEEHAN of Germantown. Mr. President, the fact of the matter is that so many thoughts came up in my mind during the interesting discussion this morning that I did not trust myself to say anything,



for I thought you might tire of me. There are one or two salient points which may perhaps be worth an additional thought or two beyond what has already been expended on them.

We have just had some talk about roadside planting and legislation which has been adopted in regard to advancing the planting of trees along the roadside. I look upon this question not only as a taxpayer and a practical man, but, as some one has suggested, I am also a legislator, being a member of the city councils of Philadelphia, and we have to hold the purse strings of the community, and we have to compare these matters with the condition of the treasury. So I look at this question of planting trees along the roadside from the practical standpoint, and as to what good it will do in lieu of forest trees. As I have heard the question, it is robbing Peter to pay Paul. Will you have good roads, or take the money you ought to have for good roads and plant trees? I cannot see the practical wisdom of that, for good roads are as important as good trees. Trees along the roadside will, on the great timber question, have very small effect, because no roadside tree has a trunk useful for timber purposes. It is allowed to grow with short trunk and spreading head. In a forest they are grouped in, and then it is not necessary to have them trimmed. In the roadside tree all the tree's strength goes to extending the side branches instead of making trunk. So though you rob Peter to pay Paul, you get no practically good results from it. You have neither good timber nor good roads. And there are results against agriculture by trees along the roadside. They tend to keep moist and damp, but to a certain extent only. It is wholly by shade of branches. So far as the drying tendency of trees as a whole is concerned, it is well known that nothing tends to make the ground drier than the roots of trees; and so far as the under surface is concerned, the tree drains right under. The Eucalyptus trees have been planted in marshy places in Rome, and they act almost as a steam pump in getting the moisture out of the ground. Thousands of gallons of water a day go through the leaves of a large tree.

I have been, in my day, a road engineer and contractor, and in my experience I know of no ground so dry as that which is underneath a forest. We all know the immense powers of grass and vines to dry moisture from the ground. A cucumber or squash vine will absorb many a gallon a day. So in reality the ground is the driest under tree shade; and trees rather dry a road than keep it moist, except so far as the surface shaded by the branches is concerned.

Indeed a great objection that some people have urged against trees along a roadside is that they not only dry the ground under them, but the earth for hundreds of yards into the fields intended to be cultivated is practically useless from this cause. This is one of the greatest reasons for cutting down the trees, in order to get the moisture and dispense with the shade, the moisture being drawn by the trees to such an extent as to prevent other growths near the trees. Then fencing is getting higher, or the cost of fencing, and we want live fences. But we cannot have live fences, because the road trees dry the ground, and orange or other things will not grow under them. There are so many other disadvantages about roadside trees that it becomes a proper question whether the law enacted for its encouragement is a wise one or not.

Now, in regard to the question of teaching horticulture in our public schools, I think it ought to be taught in some way; but not as a

subject of general study. I have been a school director for twelve years in one of the largest school districts. There are three thousand children and seventy teachers under my immediate supervision, and in the whole first district one hundred thousand children, and, as I have made it a subject of special study, I visit those schools and teachers so often that there is not one I do not see once, on an average, every two weeks. This gives me some opportunity of familiarizing myself with the studies taught in those schools, while I am also in the common council, and for four years was on the school committee of that body, which has the immediate distribution of the money for school uses. So I have had a very good opportunity of studying school systems and school costs. I find one of the crying evils in our school system is the crowding in of a large number of studies, this to such an extent that there is not sufficient time for any. In one school I know there are ten branches taught in five hours, and before they get through in the afternoon they have almost forgotten all that they learned in the morning, and what is taken in the afternoon as learned is forgotten by the next day. In our schools they are talking cooking and washing, and have actually sewing, and now have taken up the kindergarden; they cost \$25,000 a year. Thus it goes until about one-fourth of our available revenue is taken up for education. A councilman must count the cost, while as a director he must study the effect of the system.

Now, there are the taxpayers, who say they do not care how much you assess for purposes of education, but when they come to be taxed, they cry out. In fact, high taxation is one of the greatest evils a community can be afflicted with. So one of the first duties of legislators is to cut down taxes. If we were to teach horticulture, or the elements of it, it simply means increased taxation, which the people will not bear. So it becomes a question how much we can teach for so much money, if we must cut our coat according to the cloth.

Another drawback to teaching forestry would be the utter ignorance of our teachers on this question. I was much interested in the remarks of the gentleman who spoke about getting the scholars and school directors together. He said nothing about the teachers, whom I look upon as the most important factor in this connection. In our schools botany was added to our curriculum, and it is amusing to hear the teachers talk about it in the classes. Those who know nothing cannot teach others to know.

Arbor Day was observed in but a few cases about our city; but the efforts at tree planting were not entirely successful. In one instance to my knowledge a hole was dug down two feet, and a tree planted therein about as a post would be. To fill in the earth about the roots they would be obliged to get on their knees to do it, as the Governor said. Of course the tree died. Arbor Day is an example. There was a bad example. To plant a tree, and have it die afterwards, is no example to set children. Begin with the teachers, and have them learn in some way the elements of horticulture and forest culture, so that they may know how a tree must be treated in order to live and grow, and that there must be something furnished by nature for the leaves and branches to feed upon. If these were taught to our teachers on Arbor Day just as though that subject were in order, I think that much would be a good plan.

When the paper was read, "How much we might advance the forest interests in Pennsylvania?" it brought to my mind the essay of



Dr. Anders, in which he pointed out how valuable trees were as sanitary agents. It seems to me we have a good hold in favor of forestry in Pennsylvania in insisting upon the sanitary advantages. In that alone we should have a strong point. It is an argument for open squares in towns and cities. The city of Philadelphia is engaged at the present time in the very laudable occupation of locating small squares over an area of one hundred and twenty square miles. Nothing has been done since William Penn. Since that time no provision has been made for open squares or places in that city, and one may go now four or five miles in a single direction with nothing more than the public sidewalk where a person can draw a sick child for a breath of air. Philadelphia has wakened up, and they are endeavoring to locate small tracts of ten or twenty acres over its surface till now given up to brick and mortar. It became a question with the Forest Association how far they, as a body, might join in favorably to create public sentiment, and thus encourage the councilmen to act, for council are somewhat sensitive of public opinion, and do not feel justified in buying those large tracts, unless they have some public opinion to sustain them. But it seemed to me that plots for mere public squares hardly came within the scope of the association, but I do think so after hearing Dr. Anders' speech to-day. For sanitary reasons places where trees may grow are necessary, and not only trees but flowering plants. It seems to me a very valuable part of the duties of the Forestry Association might be in aiding Philadelphia and all cities of the State in getting places to plant trees and flowering plants for sanitary reasons. I think it would be a great reason for promoting forestry interests in this State, in showing the more practical uses for trees and flowering plants as tending to ameliorate and make more healthful climatic conditions. Those were matters that struck me as of special interest, and I hope other gentlemen will contribute something more.

One gentleman remarked on the fact that the Forestry Association originated in Philadelphia, and that city people do not know the wants of people outside of that city in the State. It struck me that that is the place of all others where a knowledge of the results of what is needed could be learned better than elsewhere; for there is no part of the State where there is so much planting going on as in the neighborhood of Philadelphia. Within a radius of twenty miles from the center of Philadelphia there is more planting in one year than in all the rest of the State together. So the experiences of these people as to the ratio of growth and the kind of soil to this kind of tree or that, or this plant or that, being better than another are practical matters which there alone is learned to the best advantage. Much valuable information can be had where so much is done, and practical suggestions can be had there better than in any other part of the State.

Prof. F. T. ROTHROCK. The Pennsylvania Forestry Association cannot remain under the imputation of doing nothing in this public square movement. If our good friend (Mr. Meehan) had been present at the last meeting, he would have found that at least one-half of the president's address was devoted to that subject.

M. L. LUNDY. This year we tried to plant trees near William Penn's old elm tree, now occupied as a board yard, which the county of Philadelphia had set apart. They said, "You cannot plant trees there; you cannot preserve them." We tried our best and in force.

H. W. KRATZ. I intended that the teachers should be among those mentioned on Arbor Day. I do not think that any of us meant that we should have a regular text book on forestry and horticulture, of which I think every teacher can gather enough from practical experience and physical geography to give sufficient instruction upon the value of trees. A child under the head of physical geography can have enough given on climate, rivers, &c., to be well versed in practical knowledge of trees, and in that direction they can get enough instruction upon the fact of the value of trees.

R. S. SEARLE. A gentleman has said that you must teach the teachers. How can you get them interested in the work? I would suggest that some one attend each county institute, when all the teachers of the county are gathered together, and give them a lecture on the subject.

H. M. ENGLE, of Lancaster. This matter assumes a great many different phases. Probably I might refer to one not taken into consideration, and that is nut culture in connection with forestry. Timber lands might be turned to good account in that direction. I am satisfied that there is not enough cultivation of this kind of timber, and that would be a matter of importance in that direction.

I think the chestnut would lead; but there is the English and black walnut, the butternut, the shellbark and other nuts which might be raised and made a source of revenue in addition to the timber. Of course with a tree grown for its timber, nuts could not be utilized as the timber could; but they could be rather than the bleak crests and miles of barren land. There are many places where forests of nut trees can be grown, chestnuts particularly.

I have been interested for some time in nut culture, and I have been trying an experiment which I think will become of value to others trying it. So far as chestnut forestry is concerned, you all know that in chopping down chestnuts shoots will grow up at once, and the timber will be just as valuable in twenty-five or thirty years as the parent trees. We are experimenting with some improved chestnuts grafted on chestnut sprouts. I am now interested in a tract of this character, where we have grafted four or five feet from the ground. As they are growing well, and very strong, I am satisfied they will produce nuts in one-fourth the time that young trees would planted. I think it would be well to try nut culture in that direction; it might be auxiliary to forest culture. The trees of course would not stand so close as when you wished them for timber; but they should be standing sufficiently close to make forest in a great measure. As nuts no doubt will be improved by and by the same as our fruits have been, we may expect more valuable varieties ere long than we have now. I predict that in a decade or two hence we will have as great improvement in nuts as in fruits and other things.

Hon. G. D. STITZEL of Berks county. There are two points that we all agree on on this subject that has been discussed pretty thoroughly, first the beneficial results of forestry in a sanitary point of view; and, secondly that our forests are very rapidly diminishing, rather faster than we like to see. Now the next step is the remedy. I do not think that many of the gentlemen who occupied the floor have given that consideration enough. There was a little matter suggested to me as the discussion was going on that I will just hurriedly refer to. Down in our county the agricultural society that I have the honor to represent here, some years ago offered premiums, and, after all, this thing



comes down to a money consideration in some way; in whatever way it may be called, our agricultural society offered premiums: first, for the largest number of trees planted—fruit trees of course—there should be \$100 00. The man that planted the second largest number, another premium. Two years after this resolution had been passed and advertised, the committee had a session and formulated a little programme, and these premiums were paid out. A committee started out and went around all over the county. By actual count it was ascertained prior to the awarding of these premiums that fifty thousand trees had been planted in our county. There may have been a great many more, but not entered. The committee had no instructions to ask those who did not compete. Only the trees of competitors were included in the enumeration.

Then the committee went further, and offered premiums for the best regulated orchards. They had a very decidedly beneficial effect. It strikes me that arbor culture has been a failure to some extent, because something of this kind has not been done.

In traveling around my county I see many trees which had been planted one year destroyed the next. It seems to me where a tree has been planted there ought to be some plan to have it protected. There is no use in getting down on your knees, or otherwise, if your labor is to be in vain. You have a field along a road, with fruit trees, and unless you keep dogs and a high fence, you have your trees destroyed as well as your fruit. It seems to me that the rising generation have not been taught to respect and protect the trees as they should.

#### WHAT FOREST LEGISLATION IS PRACTICABLE IN PENNSYLVANIA.

By B. E. FERNOW, *Chief of Forestry Division, Department of Agriculture, Washington, D. C.*

The forest legislation which is needed in Pennsylvania as well as in most other States, must be directed, first, to a better protection of the forest property which we have from nature's kind hands, as long as it may last; secondly, to a protection of the future crop, as far as nature has kindly restored it or man has planted it; thirdly, it is to provide and make accessible such information as will enable the people to utilize their forest growth to better advantage, will enable them to see the necessity for reforestation in certain places and the desirability in others, and furnish the basis of a rational system of forest management, just such as we attempt to introduce into agriculture; fourthly, legislation may go so far as to recognize a temporary need of directly encouraging private activity in planting and caring for forest property by means of temporary financial assistance, or other aids, reduction of taxes, etc.

*Fire laws.* The first call for legislation is one that nobody can find improper.

Everybody, every sensible man, admits the necessity, or at least the desirability of protecting forest property, like all other property, from fire.

Prevention of fire is of course better than fighting fires, and any regulations that will reduce the chance of danger from fires should be first considered. These can generally be only indirect. But one direct and legitimate manner of preventing fires from one cause, is in our hands; we can enforce the use of spark arresters in locomotives by railroad companies, such appliances are used with entire satisfaction on most locomotives of the Pennsylvania Railroad Company and elsewhere. An additional order, to keep rights of way free from inflammable material, which is easily accomplished, and fixing the liability of damage on the part of the companies, dispenses of one class of fires, and not a small one, easily.

A rule providing that all firing for purposes of clearing be done at seasons when the least danger from spreading exists, and only after due notification to the neighbors and proper authority, will lessen another cause of fires.

Fires arising from negligence, wilfulness or malice, can only be obviated by making people less negligent, and by punishing the wilful. But this cannot be done simply by enacting a law providing all sorts of things and threatening all sorts of punishment. Providing the machinery for the enforcement of the law is of more importance than the enactment of the law; in fact, the forbidding by law, which is so easy, will never meet the case; it is the *organization* of communal and private interests for carrying out the law which we must look after. If the community is made aware that it costs them something to have a fire put out, if everybody can be forced to help extinguish the fire or be fined, and is held strictly accountable for acts by which injury comes to another, everybody will be more careful for himself and will also help to guard against others. When, in addition, a designated fire warden is charged with this interest of the community, and a higher authority with looking after the due enforcement of the law, we may hope that the laws will not remain nugatory, as they have largely hitherto.

The Pennsylvania fire laws of 1869, 1870 and 1879 contain much that would recommend them, but they require to be amplified, consolidated and made applicable to all parts of the State. My own experience in the application of the law of 1870, for the last eight years, has been entirely satisfactory. An expense to the county of less than ten dollars during this period was the only cost occasioned by the only fire which the fire warden was called upon to extinguish, while before the appointment of the fire warden fires were of yearly occurrence. Legislation in this direction is so important that it should form a full and comprehensive chapter of its own and not be mixed with anything else of forestry legislation. It is simply the moral obligation of the State to do its duty in protecting my property efficiently which I call upon—forestry or no forestry.

*Stock laws.*—Next to the fires, cattle must be ranked as most injurious to the future of forest growth. I have had more annoyance from stock running at large than from fires, and I am almost tempted to say that in some localities the tooth of the cattle does more harm to the promising young growth of the future than the fire. I do not admire fences, they are a waste anywhere, and show a lack of appreciation of personal and property rights, a lack of discretion or knowledge how to behave. I admire still less the idea that I must bear the expense for my neighbor's neglect, when he allows his cattle devastate my property. After my coppice has grown out of reach of the cattle, say



in four or five years, I would not object to allow my neighbor's cattle to roam through it, and where few cattle range over large tracts, the damage is perhaps not appreciable at any time.

The interests of different parts of the State in this particular differ greatly. A uniform stock law, optional to counties or even townships seems called for. Here too, the machinery to put the law in operation and to insure ready redress of grievances, is of principal importance. Whether the enforcement of such laws could not be made a duty of the fire wardens may well be considered, as the cattle are often doubtless the indirect reason for firing woods.

In the legislation which deals with the forests as property, I will not claim, as I might for good reasons, that it should be considered as a property requiring special care by the legislator and judiciary, but let us at least have it considered as good a property as any other and deserving as much consideration by legislators, by judges, and by our neighbors.

Such laws of protection as I have cited can be set in operation in the State without involving any new ideas of State interference. As regards laws which restrict the use of the forests by their owners in any way, I do not believe we can educate our communities to see the necessity in time to effect anything like forest preservation. The wasteful practices of the lumberman, and of the tie-cutter or bark-peeler, have brought the natural supplies of the State, in less time than was necessary, to a condition when the white pine is nearly exhausted and the hemlock following fast; when the hard woods are mostly reported second growth and of poor quality, so that the Lehigh Valley railroad must send to Virginia for ties; and manufacturers report from forty to fifty per cent. of their white oak supplies from other States. This is a sad state of affairs, but admits of no immediate remedy.

Nor do we regret so much the unfortunately wasteful removal of the old growth, which grew to be utilized, as we do the absolute disregard to the renewal of valuable growth.

There are barrens and waste brush lands on many hills and mountain sides, which, unfit for any other use, should be growing a valuable wood crop for the future.

I cannot enter here upon a discussion of some mooted points as regards forest influences. Whatever may be the truth as to their influence upon the climate and especially upon rainfall, I leave to those to find out who are ever ready to fight in the clouds, on theories, without a proper basis. Those who deny the influence of the forest cover on the waterflow in springs, brooks, rivers, and on soil conditions and agricultural conditions in general, I must here briefly dismiss, with the advice to pray for light, insight and knowledge.

Ignorance has had a large share in the useless haste with which the rich gifts of nature have been wastefully disposed of, and ignorance also clouds the future of our forestry interests.

The next step then, after protection is afforded, that I would propose, is to provide that knowledge upon which proper legislation can alone be framed. If "ignorant legislation is criminal legislation," it behooves legislators to acquire the needed knowledge of the conditions of the object of their legislative action. An annual or biennial canvass, made with the aid of tax assessors, of the forest areas and their conditions, as also of the lumber business and the various wood-working establishments, with a view of keeping an approximate idea

of supply and demand before the public, seems highly desirable. Other statistics, which will aid in a proper appreciation and consequent rational legislation with regard to forestry interests, will suggest themselves.

For the gathering and digesting of such statistics, I would propose the appointment of an energetic Forest Commissioner, well fitted for position, well paid and suitably provided, charged also with the forestry interests of the State in all their bearings, who should interest himself in seeing fire and forestry laws executed, who should furnish such information as is needed by forest planters, legislators, manufacturers, etc. You might delegate such duties to an unpaid Commission: that is cheap and correspondingly useless; you might impose these duties upon your Board of Agriculture, and with such an efficient secretary and excellent personnel of the Board as you have, I have no doubt they would do their best. But the best horse put to an overload, will pull himself to death or become a balker.

That the gathering of such statistics as I have advocated and the other duties outlined, must be entrusted to a man specially fitted and specially charged with such work, is evident, if you wish to accomplish anything of note. If you want to legislate for forestry don't begin with half measures and instead of launching out in half a dozen directions, have one thing done well. An efficient Forest Commissioner, well provided with the necessary funds to do his work—good work costs—will repay soon the expenditure to the State, by an awakened interest in forestry matters on the part of the community, by an appreciation of the importance and the position of forestry towards all other industries, by affording a proper basis for intelligent legislation, and by dispelling the ignorance, which keeps our people from giving more attention to this great interest. If you have more money to spare for this interest, there are many ways in which it can be properly and effectively applied.

Among other methods by which State legislation can dispel ignorance, I would suggest the endowment with funds of your State Forestry Association, which with so much zeal and energy has engaged to do their missionary work. The collection and distribution of information might be partly accomplished by the aid of this association, if the State would enable it to do so, and I am sure such encouragement of associated effort would soon be appreciated in every county.

A wandering lecturer, supplied by such an association, without the interference of political preferment, and acting in harmony with the Forest Commissioner, who should arouse to intelligent action and instruct the people in forest management and forest culture, might soon produce as good results in the care of young forests and the enforcement of the laws as such institution has brought about in Switzerland.

I do not consider that we are in need, as yet, of full forestry schools, but the Agricultural College, to be worthy of its name, should be enabled to give a course in forestry as one of the branches of soil culture.

The State Agricultural Experiment Station should be enabled to make such laboratory and field experiments as are needed to show the true value of timbers, to show the dependence of their quality on the particular factors of site, to ascertain their rate of growth, and other laws upon which a forest management must be based.

There still remains to be considered the legislation of direct encouragement to tree planting. This, in my opinion, is the last to be at-



tempted, the most difficult to devise and execute, the most harmful to the morals of a community if not properly framed and guarded. If there is not proper authority provided to watch over the compliance with conditions upon which the community extends its helping hand, I should say, don't touch it. Yet with a Forest Commissioner to look out for the interests of the people, such direct encouragement is not impossible. But your aid must be adequate and be really an encouragement.

The provision of your recent law, which will allow me a release of taxes for three decades of 45, 40 and 25 cents per acre at the highest, does not even encourage me to undergo the trouble of asking for it, although I have some 4,000 acres which I could bring under the provisions of that law. A distribution of plant material, free or at nominal charges, in sufficient quantities to those who wish to plant their waste places to trees, it seems to me, would be more encouragement, less trouble, and answer a better purpose.

To give you an idea of what I mean by sufficient quantities, I will state, that poverty-stricken Prussia—with an excellent forest administration and a people fully alive to the importance of forestry, distributed last year, free of charge, over 38,000,000 seedlings and 24,000 pounds of seed, at nominal prices. The United States Government encourages forest planting by the distribution of seeds and seedlings to the value of about \$500 a year.

In same localities the forest cover is of such importance that its removal or even deterioration, brings in time hardships upon large districts which depend for the regularity of their water supply upon such forests. Here enters a new aspect of legislation, for which there seems to be no precedent, unless we can find one in the control of waters and roads, in which the higher rights of the community allow interference with private rights. Such localities, however, are not very frequent except in mountain districts.

Mountain forests such as these, must either be owned by the State, community, or county, or else their interference in the manner of utilizing the same is called for.

It may be wise for the State to own such tracts and maintain the same as forest reserves. At least a State law which will encourage the holding of forest areas by townships or counties, and their administration under direction of the Forest Commissioner, is highly desirable. There is no reason why a township or county should own and manage a forest, when it is in the interest of the community to so own forest property, just as they own and build roads, bridges, and school-houses, or as a city own its municipal buildings and other property. The community is not only richer than the private man, but is longer lived and can more conveniently wait for returns. Let then, where public interest should demand afforestation, the community step in and plant the forest on the land of the private owner, charging the outlay in the form of a lien or mortgage upon the growing forest, with all the rights and liabilities that usually pertain to such investments, except that the interest may accumulate until the crop is ripe and ready to be marketed, when the loan with accumulated interest must first be repaid, before the owner reaps any benefit. Any such forest planting, now begun, will at the time when the crop becomes useful, prove such a satisfactory investment that no further encouragement for careful forest management will be required by the harvester.

I could go on suggesting possibilities without end, for proper and feasible legislation, but must end somewhere. I therefore summarize with the simple statement of legislative action in the interest of forestry, which is practicable and needed for Pennsylvania without delay, in the sequence in which I state them.

1. Consolidate, extend and amplify the existing fire laws of 1869, 1870 and 1879, and perfect the organization which is indicated in the law of 1870, for the execution of the law, and include the suggested rules in regard to railroad companies.

2. Draft a universal stock law, optional to counties or townships.

3. Appoint a Forest Commissioner, with adequate appropriation, to look after the execution of the protective laws, to gather statistics, and for other duties, as outlined.

4. Endow the State Forestry Association with such sum as will aid their work effectively.

5. Enable the Agricultural College and Experiment Station to do, what they ought to do and can do for forestry.

6. Appropriate funds and devise a good plan for distributing plant material to those who would engage in forest planting. With such legislation, carefully prepared, I am willing to place Pennsylvania first among the States, as far as intelligent forest legislation goes; and I have no doubt, that within a year after the operation of such enactments, all further legislative action that is possible, will suggest itself, and a bright future for Pennsylvania's great forestry interests will be assured.

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#### HAS THE DESTRUCTION OF THE PENNSYLVANIA FORESTS REACHED THE DANGER LINE?

By N. F. UNDERWOOD, *Member from Wayne, Lake Como, Pa.*

The interest of the agriculturist in the forestry question is of a two-fold character. First, as to the effect which a lack of arborescent growth may have upon climate, upon the growth of farm crops, the water supply of farms, etc.; and, secondly, as to the supply and price of lumber and timber, so largely used in erecting and keeping up suitable farm buildings. How far the destruction of forests effects climate is a question which must be referred to men of science, whose opportunities enable them to observe the effects in many localities, rather than to the local observer engaged mainly in practical affairs. That the clearing away of woodlands does result in drying up springs and rivulets, diminishing the flow in streams, increasing the liability to destructive floods, and giving free scope to piercing winds, are facts confirmed by the experience and observation of many. The moderating effect of trees and shrubbery, planted about farm buildings in the form of wind screens upon the rigors of our northern winters, have also often been noticed and referred to, yet how few have as yet availed themselves of this comparatively inexpensive protection from the winter blasts. I must be content, however, to leave this part of the subject and confine myself to the more practical part, relating to timber supply. The statistics bearing upon this part of the subject are not as full as I hoped to be able to get, yet I trust they may throw some light upon the question of how much timber



yet remains in our State, its distribution, and the length of time it is likely to hold out and supply our wants. I may say in the outset that the principal kinds of building timber found in Pennsylvania are pine and hemlock. So far as I am informed the great body of the pine timber is confined to the regions watered by the west branch of the Susquehanna and the Allegheny and their tributaries. The hemlock is almost entirely in the northern part of the State, with many northern counties now practically destitute. Beech, birch and maple also occupy the northern half, where extensive forests of these kinds yet remain, with linden, ash and cherry, which also follow the mountain region farther south, while the oaks and chestnut find their congenial home in the central and southern portion, and furnish much valuable timber for fencing and building. Besides the regular traffic in lumber for building and fencing purposes, there is a constantly increasing demand for timber of nearly all kinds, to be worked up into various manufactured products. To supply the acid factories nearly all kinds of what are called hard woods are indiscriminately used. The products of these factories are pyroligneous, or wood acid, in the form of acetate of lime, wood alcohol, now largely used for various purposes in place of grain alcohol and charcoal. A few years ago a single factory supplied the entire demand, but at the present time a large number of factories are in operation, requiring hundreds of men to cut the wood from many hundreds of acres every year. Excelsior factories are also being established in many places, each one consuming a thousand cords of basswood and poplar wood annually. Manufacturers of umbrella and parasol sticks and printing rollers are after the maples. Slate makers use up large quantities of beech and cherry. Chair makers, clothes-pin makers and barrel makers want birch, beech and maple. Furniture manufacturers make drafts upon nearly the whole list of Pennsylvania woods. The thrifty and tough second growth ash is eagerly sought by manufacturers of scythe-snaths, cradle-snaths and fingers, rakes and handles for shovels, forks, hoes, etc.

The three great lumber markets of the State are Philadelphia, Pittsburgh and Williamsport. The latter, though mentioned last, undoubtedly handles and distributes more Pennsylvania lumber than both the other two. Philadelphia absorbs and consumes large quantities of lumber, but distributes little grown in the State. The lumber from the Allegheny river region is divided between Pittsburgh and more distant markets down the Ohio, but of the traffic in that section of the State, I cannot speak advisedly. Some statistics of the Williamsport lumber trade will be given further on, but first as to rafting lumber on the Delaware river. The first raft of timber ever run down this river was run in 1764, by Daniel Skinner, of what is now Damascus township, Wayne county, and consisted of a few pine spars, cut near the river bank. As the settlements along the upper Delaware increased, rafting lumber down the river became one of the principal industries in Wayne county, and in the counties of Delaware and Sullivan, in the State of New York. As early as the beginning of the present century, the business had reached considerable proportions. I have no data to determine the time of greatest production, but it was probably between 1850 and 1870. Up to the latter date, no record of the quantity run has been kept, but in that year the Delaware and Hudson Canal Company stationed Judge Thomas J. Ridgway at Lackawaxen, where their canal crosses the Delaware, with instructions to keep a record of all rafts run, which he has done, and through his courtesy I

am able to present the following statistics. The number of rafts run in 1870 was, in round numbers, 2,900. In 1871, 3,200, which is the highest number run in any year of which a record has been kept. It then commenced to decline, dropping next to 2,600, then to 2,300, 2,000, 1,800, 1,700, 1,500, 1,100, 900, 800, 700, until in 1887 the total number of rafts of all kinds was 678. Of the kinds of timber contained in these rafts, Judge Ridgway says, "About three-fourths of the timber was hemlock, and one-fourth pine, maple and bass." The hemlock rafts would probably average 40,000 feet, which would represent about 96,000,000 feet of hemlock rafted down in 1871, and about 20,000,000 feet in 1887, a falling off of nearly four-fifths in sixteen years. I think the actual hemlock lumber and logs run in 1887 was less than the amount above stated, by several million feet, as many of the rafts counted as hemlock and included in the estimate, were small round timber, called toggle-timber, used in wharf building. Practically, the rafting business on the Delaware is a thing of the past. Wayne county has still a few scattered hemlocks left, but very little to export. Lumber at the mills there to-day sells for \$10 per thousand feet, which is the outside price at which it can be sold out of the raft in the Philadelphia market, and then, between counters and buyers, the seller stands a chance of getting done out of 10 per cent. of the amount of lumber he puts into the raft. We no longer have to allow the buyer to name the price and make out the bill to suit himself. For a few more years, a few rafts will be brought down, but soon the last steersman will have made his last trip on the Delaware. Of the counties in New York which have formerly contributed to the supply rafted down the river, Sullivan is now even more destitute than Wayne, and a large part of what is now cut in Delaware county, is either used at home, or shipped by rail to eastern markets.

From the report of the board of trade of the city of Williamsport, published in 1886, I condense the following in relation to the lumber trade of Williamsport and the West Branch Valley: "In 1846 a charter for the Susquehanna Boom Company was obtained from the Legislature, and it was organized in 1849. The original stock consisted of 100 shares of \$100 each; at present the capital stock is \$969,600. Up to the present time the expense of building and maintaining the boom has exceeded \$1,300,000. The following official record kept since 1862 will show the extent of the business of the boom:

Years.	No. feet.	Years.	No. feet.	Years.	No. feet.
1862, . . . . .	37,853,621	1870, . . . . .	225,180,973	1878, . . . . .	112,069,602
1863, . . . . .	76,475,826	1871, . . . . .	166,661,181	1879, . . . . .	190,549,111
1864, . . . . .	96,595,681	1872, . . . . .	297,185,652	1880, . . . . .	133,078,017
1865, . . . . .	72,421,468	1873, . . . . .	318,342,712	1881, . . . . .	289,826,780
1866, . . . . .	118,831,495	1874, . . . . .	180,734,382	1882, . . . . .	220,136,306
1867, . . . . .	163,196,511	1875, . . . . .	210,746,956	1883, . . . . .	303,769,838
1868, . . . . .	165,338,389	1876, . . . . .	134,396,293	1884, . . . . .	240,382,208
1869, . . . . .	223,060,305	1877, . . . . .	106,944,257	1885, . . . . .	225,347,555

Making a total for 24 years of . . . . . 4,309,125,118

and an annual average of 179,546,879 feet." The same authority estimates that at least 150,000,000 feet more might be added for lumber brought from Lock Haven by canal during said period, which did not pass through the boom. "There are 28 saw mills, great and small, embraced in the Williamsport lumber district. The majority of these mills are first-class in every respect, and one of them, at least, ranks with the largest in the world, having a cutting capacity of 35,000,000 of feet annually. From this brief outline of the lumber business its



magnitude is clearly seen, and it is not likely to decline in value, and in the number of feet manufactured during the present century. There are still great forests of pine timber in the mountains that will yield hundreds of millions of feet, and the primitive hemlock wilderness of Sullivan county, less than 75 miles from Williamsport, has scarcely been broken." From the tables given of lumber sent to market from this point from 1869 to 1885, a period of 17 years, it is stated that the total amount was 3,672,816,495 feet; an annual average of 216,048,290 feet. "This lumber is from the Williamsport market, and represents the product of the mills in and around the city only. The quantity manufactured in the West Branch Valley, when added to our total, increases it more than a hundred millions. This shows an average of 279,041,897 feet shipped each year for the whole period. These figures include the amount manufactured at Lock Haven as well as the receipts from Larrys', Lycoming, Loyalsock and Muncy Creek regions. They are sufficient to show the magnitude of the lumber product of the West Branch Valley and the vast source of wealth it has been to the people." As to the kinds of lumber here represented the tables of shipments make no mention, but from a table of stocks of lumber on hand at the close of each year from 1870 to 1886, the average was of pine 134,092,021 feet, and of hemlock 23,569,011 feet, or a little less than five and a half feet of pine to one of hemlock. During the period, however, while the stocks of pine were about the same at the close as at the beginning, the stock of hemlock had increased ten-fold. From information obtained from various sources in relation to the timber supply of the State, I present the following: Mr. James McCracken, Jr., member of the State Board of Agriculture from Jefferson county, a practical lumberman, says, "Pine and hemlock are worth 10 per cent. more, both here and in Pittsburgh than 10 years ago. Oak is worth 50 per cent. more, as we now have a railroad to let us out to eastern markets. There has been an advance of perhaps 20 per cent. in timber lands during the past ten years. At the present rate of cutting, the timber supply in western Pennsylvania will not last more than twenty years. There is a great deal of stump land upon which young timber is growing, but it grows so slowly that I think there is as much cut in one year as will grow in twenty-five years.

Mr. S. S. Van Etten, of Hoytville, Tioga county, superintendent of Hoyt Brothers' extensive tannery business at that place, says: "From the best information I can get there is now about 1,500,000 to 1,800,000 cords of hemlock bark growing in this county. There is used annually by the eleven tanneries now in operation about 90,000 cords, and there are about 10,000 cords shipped out of the county each year. Taking these figures, about fifteen to eighteen years will exhaust the supply of hemlock bark. For the last five years the number of tanneries has increased as well as an increase of bark consumed. This estimate is based on last year's business." Mr. Nathan Skinner, now of Williamsport, but formerly a Delaware lumberman, and well informed in lumber matters, estimates that 46,000 cords of hemlock bark are annually peeled in Lycoming county, all but 5,000 cords of which are used in tanneries in the county. He also says: "I think this year's stock of logs will reach 250,000,000 feet, which will probably be the largest, and from this the cut will rapidly decline, unless there is more hemlock got in." This does not exactly agree with the board of trade gentlemen, but we must remember that Williamsport always

has a boom in the lumber business, and that her people spell "boom" with a big B. Mr. Peter Reeder, member of the State Board from Lycoming county, but having quite extensive lumber interests in Sullivan county, estimates that the supply of hemlock in the latter county may last for twenty-five years.\* Of the quantity of pine timber each year cut in the State, or the amount now standing, I have no means of judging except from the figures given above. From estimates based partly upon the list of tanneries in Pennsylvania, published in the Shoe and Leather Reporter Annual for 1887, and partly upon other information, I think the quantity of hemlock bark peeled in the State each year cannot be less than 500,000 cords, and is probably much more. Allowing six cords to the acre, which is a high estimate, and we have 83,333 acres cut over every year. Allowing that each cord of bark represents 1,000 feet of lumber, which is a low estimate, and we have 500,000,000 feet of hemlock lumber cut in the State every year. To understand the full force of these figures one must have some personal knowledge of forest areas, and some experience in woodcraft. The answer to the question, has destruction reached the danger line? will depend upon the answer given to several other questions. How large a timber area still remains in Pennsylvania? What proportion of what remains is being cut each year? At the rate it is being cut, how many years will the supply last? Is the rate of cutting likely to increase or decrease? How much of the land from which timber is cut is again allowed to grow young timber, and how long will it require to grow a second crop of usable or merchantable timber? Some of these questions have been asked by the Forestry Committee of the State Board of Agriculture, and the answers given may be found in the reports of the proceedings of the Board. The question, how large a forest area still remains? is a difficult one to answer, as no reliable table of woodland areas in the several counties, is at present to be found, so far as I am aware. The director of the U. S. Geological Survey is now endeavoring to get an estimate in all the States, by counties, of the area of timber lands, and of the quantity of timber of all kinds still remaining. While this compilation will be only approximate, it will probably be much better than anything we have at present as a basis of calculation of timber supply. From what can be gathered, it would seem that the situation may be summed up about as follows: There is no immediate danger of a short timber supply, or of unreasonably high prices. The present, or an increased rate of cutting will continue as long there is room to maintain it. The time is coming in from twenty to twenty-five years when the harvest of Pennsylvania timber will be over, and not until nature's inflexible law, which requires a season of sowing and planting, a time of nurture and tending and waiting has been fulfilled to the letter, can there be such a thing as a second crop. A few kinds of timber, as the chestnut and linden, may renew themselves by sprouting, and at the end of a generation the same land may furnish a new supply of timber of respectable size, but in the case of the hemlocks, the present growth of which is so surely doomed to destruc-

\* Potter county at the present time undoubtedly contains more hemlock than any other county in the State, and nowhere is it being cut more rapidly. Tanneries are numerous, and one lumber operator, M. J. D. Goodyear, of Buffalo, peeled this year 65,000 cords of bark, all of which is shipped out of the county. The lumber shipped out of this county every year must run up into the hundreds of millions of feet. Good judges estimate that twenty years or less will use up the hemlock in that county.



tion, there is no such thing as a second crop. What a generation would do for the quick-growing and rapidly-renewing kinds, would require a century of waiting in the case of the hemlocks. While it is undoubtedly true that in twenty or twenty-five years the supply from our Pennsylvania forests will be practically exhausted, it does not necessarily follow that the next generation will experience a timber famine. At the present time, the timber of the Eastern, Southern and Western States is crowding into Pennsylvania markets and competing with the products of our own woodlands. Look over the stocks of lumber stored in the covered lumber yards of Philadelphia, and you will find in addition to all that our own forests can furnish, spruce from British America and the State of Maine, yellow and other pine in abundance from the Carolinas, cedar and cypress from various Southern States, black walnut in quantity from the South and West, oak and poplar from West Virginia, hickory from Ohio, and even the famous Sequoias or redwoods from California. The forests of the United States are still vast in extent, and for many years to come the woods will be full of timber, even when the song of the buzz-saw has ceased to be as jubilant in our State as it is at present, and the fires have gone out in the furnaces of Pennsylvania tanneries.

We speak of the destruction of forests in our State, and the popular idea seems to be that such destruction is largely wasteful and wanton. There are at least two sides to be considered in judging of that question. The red man's mode of living made him naturally a conservator of the trees. He would not, if he could, have destroyed them, for they afforded protection to the game upon which he subsisted. He could not if he would, for his implements were unsuited to the purpose. He might as well have attacked the hills and sought to level them down as to have attacked the woods and tried to clear them away. The white man's necessities made the trees to him an enemy, only a little less formidable than the red man he had dispossessed. The pioneer must have land to till, and before he could till it he must cut down and clear off the timber. He must battle resolutely, year after year, with the giants of the forest, laying them low with trusty axe in winter and subduing them by fire in the heats of summer. Gaining his victories slowly, through unremitting toil and patient endeavor, no wonder that he grew indifferent to the fate of the trees. Not until many pioneers had each cleared many acres and many noble tree trunks had been sacrificed did those that remained have any marketable value. At length towns and cities began to spring up, and a demand was created for what had before been only an obstruction to his progress. His resources were still slender, and with as little compunction as he had formerly cut down the trees and burned them, he now cut down all which had value and sold them. As the cleared area grew larger and the timber area smaller, lands which formerly had no value until they were cleared began to have some value for the timber growing on them. Investments were made in such lands in the expectation of a rise in value and consequent profit. Originally sold in large bodies, thousands of acres in extent, at a very low price, they in the course of years were subdivided and resold to settlers or smaller operators, usually to men of limited means, who, making a small cash payment, ran in debt for the balance, taking the chances of making this payment off the land by sale of the timber. In a majority of cases it was a matter of business necessity, of financial self-protection, that impelled the owner of timber lands to cut down

and utilize his trees. He had put all his ready money, and often all his credit, into his timber tract. It is for the time being his bank, and, while he may consider it a safe institution, it is at the same time an inconvenient one. He cannot draw upon it at sight and have his drafts promptly honored. He must begin to-day to set in motion the machinery which shall give him cash in place of trees and logs in from six to twelve months. To bring about this exchange he must employ all the paraphernalia of the logging camp and the log drive, all the mechanism of the lumber mill. His obligations must be met, his interest paid. He must crowd into the market along with the rest and sell his timber for the best price he can get; but he must sell it for some price. He cannot gain by holding it over; neither can he hope to profit by letting the timber stand uncut for five, ten or twenty years, for his obligations grow faster than his trees. I have never seen the time when it would be a profitable investment to buy and hold timber lands for a rise. There has seldom been a time when it would not pay to buy timber land and "skin it," as the lumberman terms it. Many large operators have taken advantage of this fact, have bought large tracts of timber land, opened up roads into the wilderness, built saw mills, and are vying with each other in skinning the timber off the land as fast as possible. Thus we see that the mighty forces of necessity and self interest conspire against the life of the trees. While this is true in regard to all kinds of timber, it is particularly true of the hemlocks. A very large portion of the hemlock lands of the State are owned or controlled by tannery firms. They have invested large sums of money in these lands and other large sums in building and equipping tanneries. They cannot allow these works to stand idle. Once started, they must continue to run, and it is the unvarying rule among tanners that whether prices of leather are high or low, whether the business is profitable or unprofitable, they must tan on as long as the supply of bark holds out, and this will continue until the end comes.

And what is the remedy? There is no remedy that will save the original forests that remain. As the others have fallen, they will in turn fall. Shall we then depend on procuring our needed supply of timber from other and more distant forests? Shall we devise ways and means for dispensing with timber, and make stone and steel serve us in place of wood? Shall necessity compel those who come after us to cultivate trees, as it compelled our ancestors to kill them? Shall profit hereafter be found in growing them as it is now found in destroying them? These questions are too large to be considered in this connection, and are entitled to full and separate consideration by themselves. The time is coming, is now near at hand, when no question will be of more vital importance to the Pennsylvania land owner than that of how best to restore the wasted woodlands of the State. In solving this problem, there is abundant room for both thought and work. It will not be wise to leave the work of restoration wholly in the hands of nature, for while nature can do, is doing, much to reclothe the waste places in our forests, nature does not always in selecting species, give us those most useful to us, nor can she unaided successfully cope with tramps and incendiaries, private and corporate, whose carelessness or malice often, in a few hours, destroys the work of years. How can nature's generous efforts in our behalf be best assisted? The State can do something. The act of June 1, 1887, is good as far as it goes, but it does not afford adequate protection against irresponsible depredators. Forestry associations can do something, but



much must be left to individual work. We have learned only too well how to get rid of trees, we need now to learn how to replace them. We shall find the last problem a harder one to solve than the other.

### PRACTICAL FORESTRY.

By THOMAS MEEHAN, *Botanist of the Board, Germantown, Pa.*

Mr. President and members of the Board of Agriculture and ladies and gentlemen: The subject of forestry in its relation to legislation has been set apart for a special discussion this afternoon, and I do not know that any wiser disposition of our time could be made, because legislators generally ask us as a body, and as a community at large, "What is it you want us to do for forests and forestry interests?" I know when Governor Hartranft was Chief Executive, and the newspapers especially were very urgent that he should present the claims of forestry to the Legislature, when he wanted to state what was required, and he looked around for information, nobody could tell him. And so it seems to-day. The Legislature of the State is perfectly willing to legislate upon forestry if only we can agree upon some general plan upon which they can legislate. It therefore becomes us to suggest a plan in order that the Legislature may aid us on the subject of forestry. It is for that reason that when called upon to speak to you this afternoon I chose the subject of "Practical Forestry." It seemed to me that if I could point out to you what is needed to encourage the planting of forests, and in what respects the forestry desires encouragement from the Legislature; if we could find what the community is willing to do, and if we could say in what particular lines their wishes were practicable, and could point out to the Legislatures of this State and other States what can be done, that we shall have accomplished some good purpose.

Now, to put this in a direct light, I will suppose myself an individual owning thirty or forty thousand acres of wood land. I naturally want to turn it to some profit and make some reasonable use of the ground. That is the first thing naturally—a man wants to make the best use he can of his property. I must know that the more densely populated the country, the more profitable my land becomes to me, and the less value the land has usually, the scarcer population. If I could bring population upon that land, build up communities around me, it would increase the value of the land materially; but if I leave this forty thousand acres of land in forests, I lose the profit which dense populations bring. You have to bring me some strong reason why I should be induced to let that remain in forest and lose all the great profits which dense population brings. You appeal to my patriotism. You say to me, "You ought not to destroy your forests. There is a question of public policy and climate involved if you cut down and clear away that forest. The rainfall will be less than before, springs will dry up, the rivers will be shallow and navigation obstructed. It seems to us you owe this to posterity to sacrifice your individual rights in their behalf, and instead of clearing land and of bringing population here, you ought to let it stand a naked wilderness for the sake of

posterity and for the sake of the climate and the future of the country." I may ask, as once did a celebrated politician when urged to do something for future generations, "What has posterity done for me?" or I may take the ground that I do owe something to posterity and sacrifice my private interests to public duty and let the forest remain; but if I am to be patriotic and sacrifice for the future, I am justified in demanding that that question as presented to me is a real and not an imaginary one. You tell me that by clearing away my forest of forty thousand acres the rainfall would be decreased, and I ask for the figures. I read history and find in it that once England was a land thickly covered with forests, and especially so when Cæsar and the Germans came there centuries ago; that now only three per cent. of forest is left there of what was once original forest covering the whole land. I see that whatever else has resulted, thousands upon thousands of people are enjoying the pleasures of living there who could not if that country had remained a dense forest, and I ask the question whether it would not be better for people to live on the land to the extent of thousands and millions than not at all, even should the result be dryer land by the denuded forest hills, and see whether we have not lessened waterfall in consequence of having less forest. But I read on and find that there is just as much rainfall there as ever before, and that navigation is not impeded, and that there is as much freedom from drought as there was in the time of Cæsar or the time of the Germans. I may pass over to Ireland and see the same thing there. The dense forests the Milesians and St. Patrick found have since disappeared—trees cut away to as great an extent as in any part of the world, yet to-day the country is as moist and the whole rainfall is as much as when the earth was covered with forest. Leaving the Old World, I come to the New, and inquire what are the effects there? Has the climate been affected by cutting away the forests? I should know all this surely if I am to sacrifice my individual feelings and benefits on account of this public good, which requires me to preserve the atmospheric moisture. Notwithstanding the results in the Old World, if you can prove that the climate of America is really affected by cutting away the forests, then probably I may sacrifice my opportunity of acquiring riches by allowing these thirty or forty thousand acres of forest land to stand. There are very few States where the statistics have been long kept, but there is one—that is Ohio. That was densely covered with forests, and the lumberman's paradise, so densely was it wooded. While probably not five per cent. of the State of Ohio is under forest to-day, yet they have the same amount of rainfall, or with scarcely any perceptible diminution, as the careful statistics prepared at Marietta show.

Then to come to our own State; take the Schuylkill river. As much water flows into that river as when the country was first settled. It was attempted, by a city engineer, to show that the water was less in the summer, though the whole during the year was the same, but this also failed. The figures were rather in the favor of cutting away the forests. In fact it was shown that in one decade more water came down the Schuylkill river than in summer before the trees were cut away.

Even in the Western States the figures do not show less rainfall after forests had been cut away, so far as modern figures can show them. With plenty of timber in some localities, the settlers have had to cut it away. To such a great extent have the forests of the Rocky Moun-



tain been cut in ten years, that from the time of my first visit, not many years ago, and the time of my second trip through that section, I hardly recognized the face of the country; yet the wet area seems to be getting nearer the Rocky Mountains than before. The area fit for cultivation is approaching nearer the Rocky Mountains from the east, notwithstanding the cutting away of the forests there. Going towards Utah, you find nearly every strip of timber is being cut away in the Wahsatch hills. But there is a great deal more rain and moisture at Salt Lake City, and the lake itself is rising, and so the figures do not bear out the argument on the score of patriotism that I, as the owner of thirty or forty thousand acres of land, am asked to consider.

Suppose, however, all these figures were correct, suppose, in some way, I can be made to believe that the cutting away of forests has some influence on climate, and that there is something in the argument that I should preserve these forests for the benefit of posterity? When I look at a forest I find that the profitable life of a tree is only one hundred years. As soon as a tree reaches maturity it ought to be cut, if at all, and before it commences to decay, it is not fit for the lumberman's axe when dead wood forms about it, and, so far as the profit from the tree is concerned, it should be cut out, if we are going to cut it at any time. When you tell me, as the owner of thirty or forty thousand acres, I must preserve the forest, I am justified in asking, "how long should I keep these? when and how should I cut them?" It seems to me that is deserving of some practical answer.

I have said that as soon as a timber tree reaches one hundred years it commences to decay, but this is in proportion to the thinness of the soil and the difficulty the tree has in getting food. Where a tree is growing on an open, level tract of land, with great depth of soil, it may live four or five hundred years and flourish; but a tree in the forest, where it has a struggle for life and a struggle for food—for be it remembered a tree needs sustenance for life as well as a crop of corn or potatoes, and the chief trouble it has is to get food sufficient in the contest with its neighbor—when it commences to decay, there is a large amount of underbrush accumulated, inviting fire, and it is almost impossible to prevent fire under such circumstances. No matter how much you do, whether you employ wardens, or legislate against railroads, or mischief makers, in some way or other the fire will come. With this decayed material and underbrush it is impossible to prevent a forest fire to some extent. When a tree gets so old that the whole underbrush is only a dead mass, the sooner it is cleared away as threatening the community the better. So I hardly know what is devolving upon me as the owner of thirty or forty thousand acres for the benefit of posterity. Am I saving the forest and losing millions only to feed a future forest fire.

But some will say when the tree gets to be one hundred years old we will permit you to cut the forest—that this is a feature the government will have some control over, the forestry commission shall decide, and the owner of property will know when and how he should cut his timber—and we will be told, too, how to clear it all away and how to care for the second crop. But I think that every practical man that looks at the forestry question must say that the second crop amounts to just nothing at all. Four or five sprouts will come up where one strong, sturdy tree grew before; and the whole mass is so thick with branches and leaves, that it is impossible for any valuable timber to grow, as in the forests where they had been cut down. And not only this, but under-

brush of various kinds and growths check and prevent the growth of the timber desired.

Few have any idea how thoroughly useless is a thick forest grove. Take, for instance, the forests of Alaska. We were told that Alaska would be a good purchase for us, if it would be only on account of its timber; that the whole country is an immense forest. I was amazed to see the timber there almost practically worthless, on account of the manner in which the trees had grown up close together. The atmosphere is so moist that the trees get a larger amount of food than in the Eastern States. The climate is good. There is no such demand for food by the roots as in the Eastern States; no resistance or force against the tree doing its work on account of the moist atmosphere. The consequence is that the trees are so thick that it is almost impossible to walk through them, but in size hardly thick enough for fence posts. Yet with the grand climate itself, if the trees had been thinned, or the trees had actually grown thinner, there would have been good results, as in some cases, where the trees were isolated from each other, I saw them one hundred feet high and twenty feet in circumference. So that in northern regions, if some care were given, we might have good forests; but on account of the thickness of the trees, growing thus together, the timber of a second growth is utterly worthless. The growing up so thickly together will make a second forest comparatively worthless. I need not go to Alaska to see these things, or far away from this locality. A trip from Harrisburg to Philadelphia would teach any one with an observing eye what I am attempting to make plain to you here. You can see along the railroad second growths of twenty-five to thirty years commencing to decay already, and in some places making up one-half of the woods, although the trunks are little more than one foot in thickness, with the dead and dying; and the first forest fire will sweep the whole thing out of existence, which it would never do in a well-cared for forest of large first-growth trees.

It seems that something else than the patriotic argument ought to be used on the owner of those thirty or forty acres of land in order to induce him to retain that forest in its primitive condition. What those arguments are I have not heard. I do not know of a single argument to induce a man to retain that forest for any particular length of time.

Suppose they are not as worthlessly thick as I have represented, and the trunks of the trees are fair, and are not seventy-five to a hundred years old, and could be cut then, would that be profitable? We have to look at facts to determine the question of profit. A few years ago a man in Montgomery county bought a farm of about one hundred and twenty acres, and about one hundred acres cleared, at thirty dollars an acre. About one-fourth of the area, or a considerable portion at any rate, was very fine wood land, and just about fit for the lumberman's axe or saw. He sold the forest part of it for about eighty dollars an acre. People thought that paid at eighty dollars, when thirty dollars was all he paid for the whole; but it was thought thirty dollars high for the whole, and probably a thought of the timber raised the whole tract in price, so that a part of the wood profit went in the first cost of the farm. Suppose the land outside the forest was really worth thirty-five dollars an acre, would fifty dollars per acre pay the man to let that forest stand one hundred years? If you will figure it out, you will find it will not pay to get merely an advance of fifty dollars an acre on it. Those are practical questions that the owner of the



land will ask you to settle before you can place the patriotism and profit before him as a conclusive argument to retain it.

Suppose I am the owner of thirty thousand acres of land that has no forest on it. You tell me in time the forests will be cleared away, and it will be profitable to plant timber to supply the market, and it will not be long before there is a scarcity of timber? Again I should want you to give me the facts. If you will look at the minutes of the American Philosophical Society, which have just been published, you will find that Benjamin Franklin prepared a communication in which he gave as a fact that the forests would be destroyed in seventeen years. Of course since that time railroads have been introduced and pushed into the forest area. But still there have been men following Franklin since the time railroads came into existence who have been giving the same prophecy that the time will soon come when lumber will bring a premium, and bring almost any price. But as civilization has increased, we are getting substitutes for wood. In Philadelphia for instance, because of the danger, no frame buildings are erected, and that alone has lessened the demand for lumber compared with what it was ten or twenty years ago. And so all over the State. And then the introduction of coal had a great deal to do with the prevention of the cutting of the supply of wood. And who can tell whether in fifty years we can get an enormous price for timber? Can you tell me, the owner of thirty or forty thousand acres of forest land, that my children, or posterity, will surely find a great demand, and get a fortune from my planting, although I may not? These are practical questions which have to be answered, and before we can get very far along in inducing people to largely plant.

No doubt there will always be a demand for timber; but that does not make any difference whether the timber has a relation to the rivers or streams. Timber will always pay some price, whether a profitable one or not of course depends on circumstances. Now I am inclined to think, as the owner of thirty or forty thousand acres of land, I should be tempted to cut away the timber and farm it. If you insist I must not, then I have a right that I should ask the Government. How do you propose to help me along in this matter of profit which I will lose if I keep or plant forests to please you?

If the proper selection of trees are made, and the proper tree is fitted to the proper soil, and the whole cared for understandingly, it is remarkable how fast timber will grow. If there should be scarcity of trees, a careful cultivation will give us a new supply in twenty to twenty-five years. Some varieties will increase an inch in diameter a year. One-fourth of an inch is a fair average for trees standing in forests, and counting the growth during the entire life. But when you come to plant and cultivate them, the growth is very large, and you would be surprised at the difference. The oak is supposed to grow very slowly, and yet an oak will send its branches some times to the length of two to three feet in a year. I have been surprised with the growth of individual trees, where they had a fair chance to grow. I measured oaks three feet in circumference that had been planted as saplings only ten years. There is not much difference in the ratio of growth of our forest trees; it depends on the soil; they like some soils better than others. But as a rule the oak tree will increase certainly a quarter of an inch a year; at other times and other localities half an inch. Thus in twenty-five years you will have a fair-sized tree, and in fifty years you will have trees large enough to

supply any demand. Therefore if it came to the worst, and we should become destitute of lumber, or the price should get up too high for such lumber to be used, in twenty-five years we could grow all the timber we wanted. If it came to the worst, we would not be as badly off as some people think. What is true of oak, is true also of almost all kinds of wood. Therefore I think if I had thirty or forty thousand acres of forest land, I should not prevent it being cut away on account of the theoretical notions about forests and climate, but I should if you make it my interest that they should stand than by allowing them to be cut. Nor can forestry be served by scattering free trees everywhere, because the wrong trees will get in the wrong places. But yet I think planting forests properly would pay. I should, I think, investigate as to the particular localities most desirable for particular trees. I should find out what kinds of trees suited my particular localities, first by experiments for a year or two perhaps before I could decide. I think I would plant them twenty feet apart, and cultivate them, raising corn and potatoes between the rows, so as to get something for my money while they were growing; and while getting larger I should employ professional pruners to cut the lower branches off, as suggested by Mr. Oliver this morning. It is important to get a good growth of trunk. If the trees are planted closely, the branches are killed or weakened by the shade, but the dead fire-inviting brush is what we don't want. It is better to plant wide apart and get a product off the remainder of the land, and the trees as an extra growth by reason of being thin on the ground. This process of cultivating should be carried on at least two or three years, or longer, to keep down weeds and encourage rapid growth. Of course the branches should be carried away and destroyed. You do not want to carry on the cultivation too far; neither at first do you want the young trees to be injured or interfered with by cattle. But then, after the trees get large enough, I do not see any reason why cows or cattle should not be allowed to graze there, and you get some profit the whole time the land is in trees. In the Western States where cattle were allowed to graze, they did no injury; it is only when the trees are quite small. This keeps down all dead brush, and is a security against forest fires. They browse under the branches, and there is no temptation or desire to get at the trees. Not being giraffes, they have not long enough necks to browse to any damage under the trees, except when quite young, when the branches extend out well, as they are quite low to the ground; but as the trees grow up, the cattle graze clear to the trunks, with no disposition to eat off the bark or leaves. With trees planted in that way, and with an income obtained from year to year in the manner I have indicated, they would pay for their cost. For a forest thus safe from fire I would be the gainer if I wanted to sell. Some person would give me the value of the land with the trees, although the trees themselves were not fit to cut, because the value point would soon be reached.

Now, I think in that way forestry planting might be made very desirable and very profitable; and some legislative inducement in that way, with the facts of profit properly presented, would cause people to spend more time and money in tree planting and would do good. But one of the most important things to be remembered is the right kind of tree in the right kind of soil, and in the right location. Forestry in our country has not been benefited by some attempts at forest planting. Ignorance of practical details have rather tended to



discourage culture than to undertake it. For instance, in English and German works we read about the great value of the larch as a timber tree. The larch was supposed to be the best of all trees for various purposes.

German and French periodicals were for years full of the great value of this species as a forest tree; that it grew rapidly, and the wood useful for all sorts of purposes. So our Western people went to work and planted large tracts through that country. After waiting twenty-five to thirty years, the timber, instead of being found as valuable as in the Old World, was practically worthless, as the larch requires a cool-summer climate. Its home is in the mountains of Switzerland and Italy, and in a cool climate, where the sun is never very warm or very cold, but where the temperature is only rather warm and equable. Planted on the low and rich level plains of the West, where the soil was too rich for it, and where the summers were too long and the winters too cold, it was practically useless. That is one of the lessons we have to learn before we attempt to plant these thirty to forty thousand acres that I spoke of; and it is one of the expensive lessons we have learned in connection with the forestry question in our country.

Now, every one, I think, must have noted, even by the most cursory observation, how trees suit themselves to different locations and different temperatures. When we travel, in nearly every country, as we rise, say but fifty feet in altitude, we find trees of one character, suited to that low land. As we ascend one thousand feet higher we find different varieties; and so until we come to the lines of perpetual snow. Nature tells us that trees have to have different temperatures, different altitudes, different soils, as may be required, in order to produce their best; and we have to bear these facts in mind when we go to plant our lands or large tracts for forestry purposes.

Now, I have given some reasons why we could hardly ask a man, the owner of thirty or forty thousand acres of forest land, to hold it for a number of years. In the first place he knows the land will increase more in value without being covered with trees. In fifty years the forest decays, and instead of being valuable for forest timber, he knows it is an inducement to forest fires. If he cuts it down, the brush that comes up afterward will only struggle for life, and he is uncertain in regard to the influence of trees on climate. Then if you come to ask him to plant, there is still that feeling that no matter how great the profit made on the land, no matter if he follows my suggestion to make something of a profit as he goes along, he would probably make a much greater profit if a population should settle there; and that is one reason why he cuts down his trees in order to increase the value of his land. By cutting away his trees, land that otherwise would bring \$50 an acre, by bringing the population there, it would be increased to \$100 an acre, and possibly to \$200 or \$300 an acre in much less time than it will increase \$50 by the trees. So if the land were not planted in forests, I would be a great deal better off financially. We have, therefore, to look to legislation, I think, to help the man who wishes to plant a forest, to get some benefit out of it within a reasonable time. But I do not think one man will ever do it. I think it must be by association. I think that forests should be planted under charters, as a railroad company gets a charter, just as my friend on my left said awhile ago, so we can get some privileges commensurate with the loss. I think that is the only way by which

legislation can help forestry. When that is done I think the stock in that association would always be at a premium. Certain trees would be coming towards market in course of time; and in a company like that the stock would be worth more ten or fifteen years after it was in operation than when the trees were first planted; so that if a person wanted to sell out his stock he could get full value for it, under a charter, working in that way; and the Legislature might give the money it is proposed to waste in commissions, on experimental farms, on teachers and lecturers and free trees, to guarantee a five per cent. dividend for the first five or ten years on the stock.

I have listened attentively to what others have said; but I do not think any person named a practically operative plan as I have. I do not think that the State, taking hold of the forestry question as proposed can realize anything out of it. Matters with us are entirely too changeable. In spite of all we can do, we cannot get a practical man to take hold of a matter of this kind for a series of years, under government control. Persons do not make life officers of their work, as they do in the Old World; but they are ever on the lookout for something better, and they will abandon forestry in a few years for something else, for sooner or later there will be a feeling that at something else they can do better. Similar changes are continually taking place in our State and in our country. Where a State has undertaken to carry out any public enterprise, it has been glad to get rid of it. In Pennsylvania, where they owned the public works, they were glad to get rid of them. So far as I know, to-day Pennsylvania has disposed of all her public works; and so with most of the States. So that if even the different States can do this with a less burden than under private management, sooner or later it will come to companies any how; of course some good will come from a forestry station; some from a Forestry Commissioner, especially if that commissioner would apply himself to collecting statistics on such subjects as the relation of climate and soil and location to forestry, and do his level best to extend a knowledge of correct tree culture among the people. A Forestry Commissioner of that kind would do great good. Teaching of forestry matters properly in schools would undoubtedly be a benefit. Arbor Day is a good thing, in encouraging the planting of trees, instilling into the minds of children the importance of tree planting and tree culture. The Forestry Association is doing a good work, and can accomplish an immense amount of good. But the great good yet to be accomplished, is the getting of chartered associations to take hold of large tracts for new forests to take the place of old tracts. But the most important question of all is that involved in the joining together of persons in the manner I have suggested, with the advantages of a charter and concession, to make the work certainly profitable to be derived from the Legislature.

Vice President M. W. OLIVER. Gentlemen, the general discussion of the forestry question from its legislative standpoint is now in order. The remark I made this morning was intended to be in the line of Professor Meehan's remarks just now. You must make a farmer understand that it is to his financial gain to keep on his farm more than a certain number of acres of forest. I have done a little figuring here from what was given by a gentleman to me, on fifty acres of timber land, worth seventy dollars an acre. He tells me it may now be put at that. If the timber had been sold twenty years ago it would



have brought twenty-five hundred dollars. That put at interest would have amounted to forty-two hundred dollars. That land rented at only two dollars per acre would have amounted to two thousand dollars, which, added to the principal, would make sixty-two hundred dollars, from which take the present market price, thirty-five hundred dollars, and the difference shows that gentleman has lost by keeping that land in timber.

S. P. EBY, Lancaster. I am very sorry that the gentleman who last addressed the Board was not assigned to deliver his address at either about the middle or beginning of these proceedings. The Board is pleased, and particularly those interested in forestry, to give the opponents, as I understand it, the last speech, which is always considered a great advantage. While I agree with him at the very end of his address, as to the best way by which we could now get some forests planted and maintained, I disagree with much that he has said. But before I come to that I wish to ask him how it is possible to believe his statement that rain gauges were kept in the State of Ohio for the last fifty years. Rain gauges, to be accurate, must be kept above the forest trees. He makes the assertion here that over the whole State of Ohio the amount of rainfall has been just so much—exactly as much as when the whole State was a virgin forest from one end to the other. Who kept the rain gauges there all through the State fifty years ago? Who keeps them now all over the State? They may be kept but we are entitled to know by whom. I am not here to assert, or discuss, or contend on that question, which is disputed and unsettled, for the very reason that nowhere in this country, in any State, has the exact rainfall been kept for the last fifty years.

Passing that by, this gentleman asserts that our streams flow in as great a volume as they did fifty years ago. Now that astonished me. If I had never lived in the country, and seen the effect upon dozens of hillsides where I spent my boyhood, where I used to go fifty years ago, and could go now, I could not help but believe the gentleman. Of course I believe he has stated what he believes to be true; but my experience is that I could go to at least a dozen places on the hillsides where there was running water fifty years ago, not only in the spring but summer time, where the timber has been cut down, and where, since, the streams have become dry. Not long since I met a farmer who owns a cleared field, where he said twenty years ago there used to be a spring, but no spring now at the surface. He dug down sixty feet before he could get water in sufficient quantity to pay for bringing it up into his barnyard. I know of another place where I was raised where there was a spring that drove a flax mill. I took flax to that mill myself. That stream turned a wheel that was at least thirty feet high. Afterwards that mill was turned into a turning mill, to turn helves, and such things as that; and subsequently into a chopping mill. The trees have been cut down in that vicinity; and now not only the mill but the stream itself is a thing of the past. The bed of that stream is filled with what has been brought from the adjoining hillsides, where years ago the roots of the trees kept the soil; and when there is a wet season there it drowns out a great portion of the land, and when the summer comes it is entirely dry. Does not the cutting away of the timber affect that? Was I not raised along a stream that rises on the other side of the South Mountain, which came down through the Coleman estate, and these iron works, and where they did cut their forests, and let them grow up again? That was a constant

stream, which they could work with or not. What is it now? Not many years ago I took my son to find a hole where I used to catch catfish; but no stream there. At the mill dam near where I was raised, there was nothing in the way of a dam of water; but the mud sticking out, and a small stream going down to the mill. I have not heard it disputed before as to the fact that the cutting away of forests does affect our streams. Why? If you go to the place where they ground grain sixty or more years ago, you will find that the water that used to be kept by the timber has all come down; at one place near us it has got down to the Pennsylvania railroad, and not enough to turn a mill, whereas the water, if it were kept on that hillside, the old spring would be restored just where it was found, with plenty of shade; and there would be an abundance of water now. By practical experience in the Old Country, after timber was restored the old springs reappeared.

Now, I ask you, what is one of the most essential things that we want to do? Is it not to restore to use the water? Is not the scarcity of water beginning to breed trouble? Do we not hear of reports from physicians everywhere, when we had plenty of water near streams it was seldom we heard of such diseases as typhoid fever, but now people are dying off. The doctors say it is on account of the water; and we go a distance away and bring water from some point where it is clear. Now it amounts simply to this: there is not a country anywhere, unless it is Great Britain, that has retained moisture enough for the fertility of its soil, unless it kept a certain percentage, of its timber, not in one or two small forest, but distributed through the country.

Now, as to the legislation we need, I agree with the gentleman who spoke last. I was going to suggest a modification of the act of Assembly which was passed, I think, at the last session. The members of the Legislature seem willing to pass an act just as we ask. I have been at the last three sessions—I have made a business of it, you may say—and have tried to act in coöperation with the Forestry Association of Philadelphia. We at last succeeded, with the assistance of that association, in having the act of 1887 passed; but after it was passed it had a fatal defect in it—that is, as to the punishment of trespassers. The only punishment that act imposes is a fine of fifty dollars. Now, no magistrate is going to impose a fine of fifty dollars upon boys that go into my forest or upon my timber lands, trespassing upon them. So that ought to be changed at the next session.

One gentleman spoke of a very important thing—I thought it was going to be lost sight of—relative to cultivating trees. Now, suppose you have a ridgy hill, where a plow cannot run, and where you cannot cultivate corn, grass or anything of that kind. How will you cultivate trees, except, as one gentleman has suggested, by planting acorns with a hoe, as I have done, and they are growing nicely?

Now, there is some legislation which I think we ought to have passed at the next session—an act authorizing the incorporation of societies for the planting and propagation of forests. In Lancaster county, all along our streams, such as the Conestoga and the Pequea, the trees are cut away and the ground laid bare. If you go along the Susquehanna river, and pass over the ground for a mile in either direction from the mouth of these streams, where they enter that river, you will nearly always see large deposits of mud. The best soil of Lancaster



county is carried down these streams, and much of it carried on down to where the wild ducks feed upon the wild celery.

If the Legislature will give us the privilege of incorporating such societies, I think we will soon have a number of them. They ought to grow up like insurance societies and in nearly every township. One man alone could not do it. These organizations should be enabled to lease or purchase land that is not profitable under cultivation. They might even, after purchasing a quantity of land, build a cabin upon it, or a house, and put a tenant therein to plant forest trees as thick as they can be grown, and to protect those trees afterwards. I think that is one of the feasible ways by which the Legislature can help us at present. We might plant them as thick as corn, and after they grow to the size of hoop poles cut out one-half. After they have grown a little larger, cut them out for hoghead poles, &c.

One thought further. I agree with what has been said, that forest land will change the course of a rain cloud. Rain will follow bodies of forest land, because there the air is cooler and there is more moisture. I have seen and observed this for the last ten years, and had paid particular attention to it before I knew anything about forestry associations or books written on the subject of forestry. I came to the conclusion that authors of some of these works have come too long before I had read their productions, although perhaps I was the only person in the neighborhood to do so. I was surprised when I took one of these books and read it, finding it to correspond with the observations I had already made. I have seen a storm rise beyond the Susquehanna, and on the York county hills, and I have seen it come toward our place by a direct course. It would continue on in our direction until it reached an open country in Lancaster county, and then it would turn toward either the river or the high wooded hills, not going in the direction where it was badly needed. Once the cloud came so heavily toward where I was watching it that I was certain we would have rain; but suddenly it turned and moved down the river. On another occasion I was confident it would reach us, because the clouds were so thick; but instead of reaching us, it divided, one portion going down the river, and the other taking along the South Mountain, where there was timber and more moisture. Not more than a dozen drops of rain fell where we stood watching it. There was nothing to prevent us receiving the benefit of that rain but the scarcity of timber around us.

These are a few instances where I have made personal observations, and I therefore cannot resist taking an opposite view from the gentleman so widely known who was last on the floor. Did I not take this stand, I would be doing injustice to myself, and acting contrary to my own observations, some of which have been made during the last five or six years.

J. McDOWELL of Washington. I move that each speaker be limited to ten minutes hereafter in the discussion of this interesting subject.

The motion was seconded and agreed to.

F. R. MILLER of Warren. Why cannot we provide for the planting of an acre without public help, as well as a few hundred apple trees? I know we can do it, for I know I have done it without any help from Uncle Sam, the Commonwealth of Pennsylvania, or anybody else; and I did not have much capital to do it with either.

J. P. EDGE of Chester. If I have had any doubts in my mind about the propriety of a forestry association in Pennsylvania, those doubts

are dispelled. I think such an institution has become a necessity for the treatment of this insanity on the forestry question. There must be a very active form of the disease, as was suggested here this morning. I was every forcibly reminded of an incident that occurred in my youth while attending a large public meeting in Norristown. One lawyer spent an hour or more in trying to prove that inasmuch as but one man can be right in his opinions, and no two men agree, that all except the man who is right are insane. A smart fellow got up after he was through and said he thought the gentleman had proved his own case without any question. (Laughter.) With the contrariety of opinion as expressed here, there must be some truth to be arrived at, and through the forestry association it could be gotten out. It would be idle for us to go and ask the Legislature to pass enactments on the subject of forestry without we could agree. Those who are interested in the question ought first to agree as to what is best to be done.

Now there seems to be a disagreement of the essayists here to-day. I think our botanist has had the disease a number of years, and it has become chronic; while Professor James seems to have the disease in the most active form. I hope, gentlemen, we will soon decide which is right.

R. S. SEARLE of Susquehanna. When doctors disagree who shall decide? The professor from the university (Rothrock) struck the keynote of the whole thing I think. He suggested that the lands of the State of Pennsylvania that were sold for taxes should be bought in by the State and devoted to the propagation of forests. Well that strikes me as being practicable. It is going to work as sure as you are born; especially if they keep on discriminating against the farmer.

J. McDOWELL. Yes, they will soon have it all.

R. S. SEARLE. With the high rates of transportation for what he produces, and the discriminations against him, by making him pay four-fifths of the taxes for the support of the government, in a little while the State will have enough land to grow forests spontaneously.

J. P. EDGE. And then we will get back to the natural state of man.

WILL B. POWELL of Crawford. One of the principal objects I had in coming to this meeting was to hear this question discussed. I think it is one of the most important subjects brought before this meeting since I have been a member of it. I presume that New Haven is one of the most beautiful cities in the country, because of the elms. Lafayette, when stationed there, for the want of something else to do, planted through those streets elm trees; and those trees have since made that city famous throughout the world. He could have erected no greater monument. If I can not leave to posterity a family, I want to leave to them a forest. I have plenty of land for that purpose, and could have in forest five hundred to a thousand acres, I think. But I do want the State to exempt those trees from taxation. I do not propose leaving on the east side of our farm a tract of timber land for the benefit of those living beyond, and I be required to pay the taxes thereon.

To show the advantages of forestry, let me illustrate—and I think there are persons present who could easily call to mind similar localities: In riding from New Castle to Harmonsburg, we came past a certain corn field that was shriveled and dried up. It didn't look as though they would get the seed back. The driver said, "On the other side of the woods I will show you a similar place, where the same kind of corn was planted the same day, and on the same kind of



soil." On the east side of those woods I saw as good a corn crop as I saw anywhere that year. Why? Because of the moisture prevailing in that piece of woods extended to the ground beyond and keeping that corn in good growing condition, while that on the west side of the woods was dried up and worthless.

I know of another place, and Mr. Oliver knows it very well. One day in August I was passing over that ground, and a certain person was harvesting his hay. It had been growing fresh and good. I saw it was a mixture of timothy and clover. It is seldom you see any not cut two or three weeks before that. I said, "How does it come to be so green and fresh?" "I do not know," he said. Here was a large piece of woodland, now called the "Jumbo Tract." I asked, "How many acres?" The reply was "five or six hundred." It was a thick, dense primeval forest. What is the result? The hay lies there the year round. It carried moisture there to this meadow, and the grass was green and fresh. I remember that my father used to cut hay in August, and that hay would be good and green. To-day, on that same land, we have to be as particular as with the wheat and oats, because it burns out; and in a few days it gets so dry and deadened it is hardly worth cutting. Why? Because the forest is cut away and the atmosphere becomes so dry that the hay will whiten and deaden so it is not worth cutting.

In the vicinity of Mr. Thornton's at one time the corn was not affected and shriveled up as much as now. Why? Because of the cutting away of the forests and making the streams dry. In our neighborhood after a rain the ground would remain moist for us for a week. Now in that same neighborhood we cannot plow it unless within a few hours after a rain. Why? Because of the cutting away of the forests. In going from a well known place in France you pass through what is called a forestry. France gives a fair example of what land will become by having forests cut away. They found they were liable to have diseases and that the land was drying out, and they bought several hundred acres where the drought was the worst and planted it to forest, and now for fifty miles in every direction, especially to the east, are they growing great crops, and the moisture has nearly reached its old-time state. Land that was becoming worthless is now valuable.

I repeat, I think if I go to work and plant a certain piece of ground with trees that will benefit the people all around me that, that the land should be exempt from taxation.

Secretary EDGE. There is one serious obstacle in the way—the Constitution says it shall not be so.

Mr. POWELL. That is true; but shall we not modify the Constitution? Experience has demonstrated to me that I would be safe in paying a dollar an acre more for pasture land that lies on the east side of a densely wooded tract than in a thoroughly cleared country; that I will have an even growth of grass throughout the year and will have more of a product. So with hay. It is not the quantity of hay that you will produce, but you will get a so much better quality with so much more life to it. Such hay retains the life better.

Dr. E. HARVEY of Delaware. In considering the influence of forest on rainfall, we must not forget that there are other influences—that all is not due to the presence or absence of forest. The climate of Great Britain is always moist and would be if there were not a tree on it. The gulf stream being warm, and the atmosphere being cooler, the moisture is precipitated from the air above, so that a comparison

during the era of the German invasion and now is of little value. As to Ohio, I do not think of anything that would be sufficient to cause me to reach a final conclusion. Forestry had nothing to do with the great drought that extended from the Pacific to the Indian territory and Kansas and southern Minnesota in 1876, or that which extended over the region west of the Mississippi last year; and yet nothing is truer of a part of a country, because when dried up from want of rain it is harder to get a local rain on it. You will have to wait until a somewhat general shower predominates over that influence. So the fact that the streams have been diminished as the forests have been cut off, is too plain for argument, it seems to me. I have seen it. That which follows is not always the result of the cause; but it looks as if it were. A summer cloud comes in all dry. Even the sign of the lightning's flash will fail in a very dry time. A cloud comes generally from the west, visible to the north and south, but in passing to the east it disappears like a wet towel brought to the hot stove, and it is perfectly dry as if no water in it. Moisture is one thing and vapor is another. Minute drops suspended in the air is moisture, but a little warmer and it is dissolved in the air—it is dissolved in the air holding it, and you notice no change in it that is perceptible to your senses. I repeat that the cooler the surface is, the more certain you are to get rain when the conditions are there; but if you are in an area of land which may have been drained by a long drought, there may be some entirely different cause for it than the one we are discussing now. You get no rain until what? A general rain. On the mountains the rainfall is found, because it is cold there. The trade winds blowing from South America, from the eastern side towards the west, rise and rise in the atmosphere and become cooler above because becoming rarer, and as the air in rising becomes cooler, it increases, therefore, in density. When it becomes cooler it precipitates the moisture, so that which held the moisture becomes dry. It is thus carried over the low lands to the mountains, and clear to the Andes, where it drops and forms the Amazon and the Orinoco, running down thence to the plains; but on the other side no rain. Why? Because the moisture, reaching this cold height, assumes a condition by which it is deposited—it dries the cloud up and it is gone. So with us in hot weather: you hear the thunder and you are sure the rain is coming; the sun does not even shine near you, but there is no rain.

Now when forest covers a considerable portion of land, vegetation, as plants, is kept cool; and it is the reverse process that keeps animals warm. The plants take carbonic acid through their leaves, and separate it, instead of being heated as the animal body; thus the plant is cool, reversing the physiological chemical process. When there is a general rain on the earth more rain will fall there than if dry.

As to the Rocky Mountains, the rain area extended further as the trees were cut off. Trees are not necessarily the cause of rainfall, it will rain just the same. You go into the tropics, and on the high mountains there is snow there all the year. In Salt Lake City the Mormons told me the rain began to fall when they brought water from the mountains to irrigate the land. When it was dry and hot no rain fell, it all fell on the mountains. That is the reason why the land along what was once called the American Desert, which is in reality a great plain, that is the reason the rainfall there was so little. As to the American Desert, that is a thing we laugh at now. Upon that they raise a little sage brush; there is plenty of land there that raises very



little else. And until the land is irrigated by streams brought down from higher altitudes, and enough to irrigate good sized tracts of country, little can be expected in the way of rainfall. Where water has been brought there is an abundance of grass, and the rains fall there.

J. A. GUNDY of Union. I wonder if some of these causes cannot be accounted for on other grounds; for instance the cause of this stream not furnishing enough water for the mill. Might it not be owing to this fact, that at the time the saw mill or grist mill was erected there was not nearly so much occasion for grinding as there was for the succeeding generation? Not so much water needed as twenty-five years after ward, when the population had been more than doubled. Did the gentleman take that into account?

Again, my friend, Mr. Powell, speaks of two pieces of land in corn. Very much might depend on the amount of cultivation. Cultivation produces moisture, by capillary attraction from below, retaining it nearer the surface, while the other tract might not have been so generally cultivated.

As to the adjoining piece of woodland where grass was grown, might that not have been owing to the amount of humus in the soil, and that retaining the moisture; and not be at all owing to the amount of forest in the neighborhood.

J. A. GUNDY of Union. Then rain is caused to descend sometimes not so much by a couple of rows of trees below as by coming into contact with something above. When this cloud spoken of passed South Mountain, would it not be elevated above the plain below, and would not the fact be the same whether dry there or not?

So we must not charge all this to forests, or the absence of forests.

W. W. OLIVER of Wayne. Last year and the year before we had very excessive droughts in our county; last year much earlier than the year before. Now, in the western part of the county, where there is a greater area of forest than in the southern part, we suffered more severely from the drought than where there was a less area of forest. Not only that, but last season the product of hay in the cleared up part was twenty or twenty-five per cent. better than in the past where there was forest. I was recently in a south-eastern county of the State of Nebraska. In one locality there ten years ago the land was considered to be a desert, with scarcely any rainfall there. As they began to buy land and cultivate the rainfall also began, and as they cultivated, progressing forward, just so fast did the line of rain area extend. There was no increase of forestry, but cultivation.

J. P. BARNES of Lehigh. After I had heard our friend from Lancaster county for a few moments, I began to doubt whether they ever had any rain there. But I suppose they have had, for they raise some very good crops.

I was going to say, as Dr. Harvey suggested, there may have been other causes to bring about a lack of rainfall, just as there are changes in our little rivulets that cause them to disappear. I know that in our locality, about ten miles from where I live, there has been a lack of water in a section of country ten miles in circumference. The cause of it is readily ascertained. There is a large zinc mine where all the water accumulates, and they are compelled to keep a gigantic pump there, which drains all that section of country. Then our streams have subterranean passages, and leave one passage and go in another direction. A lack of water supply may thus be accounted for in that way.

Mr. MEEHAN. I was born in England. I came to Philadelphia comparatively young. When I was old enough to marry, I took a Philadelphia lady for my wife; it was of considerable interest to me to be telling her for many years how different things were in England compared with our country; and how much better some things were there than here. The streets were broader there, and the houses larger and more beautiful; and every thing different compared with similar things here. This went on for a number of years, she being constantly reminded that there we had better boys and girls, and in the fruit line bigger raspberries, gooseberries, &c. Finally we concluded to go there on a visit. When we reached there I could not find these better things anywhere; and she had the laugh on me, and has had it ever since. Now we are prone to think in our own country Baldwin apples for instance were bigger and better than they are now, and that the boys are better, and that springs ran better in the past. We are not apt to allow for lapse of time, we forget that now and then springs dry up, and that streams alongside of other streams become stronger as well as weaker. Near where I reside the Wissahickon flows; some of its sources are on my property; as much water runs as ever. There are other streams, and they all run the same as before the forests were cut away. Why have not those streams dried up? If one spring dries up, why does not another dry up along side of it if rainfall has aught to do with it? The same law ought to be uniform all through. There are innumerable cases where springs would naturally dry up, water has courses underground about the same as on the surface; and anything that interferes with its flow, as crevices through a rock, will turn its course under ground as well as above. A large rock will fall down and turn the course of a surface stream. And a new obstructive hill will turn an under surface one, a railroad near by may cut off the channel even half a mile away, and one may wonder why the spring does not have the same force it used to have. Water running through lime rock will sometimes wear away the channel and pass into a new one; and sometimes there are thin strata supporting the body of water, which finally give away and change the course of the stream. I have known the digging of a cellar to dry up a small stream a little distance off; and the changes in natural features will produce the same effect. I think people very often refer to the absence of rain as producing this or that when really it is due to local causes, the change of direction of the stream being really caused by something else than the rainfall. (Applause.)

#### PRACTICAL HINTS ON FORESTRY.

Furnished by request of the Governor of Pennsylvania by G. O. PRAETORIUS,  
*Minersville, Schuylkill county, Pa.*

To His Excellency JAMES A. BEAVER,  
*Governor of the State of Pennsylvania, Harrisburg:*

DEAR SIR: In accordance with your kind request, I give below my suggestions, observations and experiments regarding the adaptation of different soils to the cultivation of forest trees in this State. I have taken pleasure in preparing this small essay on this important subject, and I mention such forest trees only as ought to receive our first attention for cultivation.



## I Deciduous Forest Trees.

WHITE OAK—(*Quercus alba*).

HICKORY—(*Carya*).

BLACK WALNUT—(*Juglans nigra*).

These forest trees will always develop well in deep, sandy, light red, or yellow loam. Soil which contains from thirty to forty per cent. sand, and is mixed with clay, so that the roots can penetrate the soil in search of nourishment, is favorable to the trees mentioned.

A layer of tough and hard blue or yellow clay, at a depth of two feet below the surface, is no hindrance to their development. If such a bed or vein of clay lies higher, or the surface is composed of it, it is useless to cultivate any of the above-mentioned trees. They will not grow. I have observed that others of the inferior forest trees remain stunted in such clay beds.

For the above-mentioned trees it is immaterial whether a section of country be planted or seeded; whether it is level, hilly or even mountainous. The main object to be kept in view is that the soil possess the above requirements.

## Obtaining Good Seed.

It is of the greatest importance that good fresh seeds should be obtained. There is nothing more provoking in forestry than to sow non-germinating seed. For this reason I will give my experience in order to show how it may be properly collected from the seed trees.

Acorns ripen in September and in the beginning of October, and sometimes in the latter part of August a few will drop from the cups. Upon examination the August acorns are generally found to be worm-eaten. But after a night's rain in the middle or towards the end of September, or during a stormy morning when they drop and hit hard and fast, the time to gather them has arrived. They should be taken to a shady place in the barn or house and allowed to dry. Afterwards they should be stirred every few days in order to avoid heating. They will soon become brown, and when the leathery cover becomes wrinkled they are ready to be placed in a cool cellar or an out-house where the temperature approaches as nearly to 30° as possible. In this way several bushels may be kept over winter if they are mixed with moist sand, but they must be looked after from time to time and stirred to avoid sprouting. Large quantities may be kept over winter in ground-cellars especially constructed for this purpose.

The acorn is the only seed of our forest trees which will start its germ in fall by the action of the warm sun and air. The young root is inclined to descend into the earth in a short time, and would germinate satisfactorily if the tender germ were not destroyed by the hard frost of our winters. For the latter reason fall planting in this latitude is not justified. It may come out all right in spring, but it is very doubtful.

My experience shows that it does not hurt the acorn to be frozen hard, and I have gathered a quantity and kept them from sprouting, and at the same time from drying out, till the beginning of November, when the weather becomes cold. I can then plant them without running the risk of having the germ started. In this way I keep them over winter in their seed-beds without the least care. These seed-beds must always be made on level ground so that rain and snow water cannot wash them bare. The acorn will germinate early in

spring and grow and develop very fast, principally when in the ground.

In the beginning of July they will have finished their growth for that year. Now, if time is money, one whole year may be gained by taking up the little seedlings carefully and transplanting them again in a plant bed already prepared. All the seedlings will be found to have a long "tap or center" root more than double as long as the young sprout above the ground. This must always be removed so that only three or four inches remain. In the new bed they should be planted about six or eight inches apart in drills. Here they ought to have four months' time to develop and strengthen the roots, which is all that is required. This is a rather quick process to raise oak seedlings, and it is worth knowing.

Hickory and black walnut I keep fresh by exposure to rain, snow and the hardest frost. The only care I take with them is to protect them from theft and against pigs. The harder they freeze the sooner they will germinate in spring. I plant hickory nuts in drills six inches apart from three to four thousand in a square perch.

The top-dressing of seed-beds should be composed of sod ashes. If the soil is of a hard and clayish nature so that it will become crusty, the strongest germ cannot push through. Sod ashes never become hard. I test acorns, hickory, walnuts and chestnuts by throwing them in water, leaving them during a night. Those that sink are solid and good, and those that swim are useless.

CHESTNUT—(*Castanea vesca*, var. *Americana*.)

We find this forest tree in all localities, from the top of the barren mountains to the fertile valleys. It is indeed a very hardy and handsome forest tree deserving more attention than it has so far received. We find the chestnut does well on all our mountains the surface of which is composed of gravel soil. The soil underneath the gravel is principally two or three parts of sand and one part of clay. On mountain slopes and further down towards the valleys, where the soil contains more clay, say about one-half, the growth is better. In such locations it grows taller and straighter and produces annually more material. In soil such as suits white oak and hickory, the chestnut in comparatively a short time comes to perfection, but it is inclined to be the predominant growth. It will make room for itself regardless of all other trees in its vicinity. For this reason it should only be cultivated with such forest trees as can keep step in development with the chestnut. It is also a great improver of the soil. The annual fall of leaves is abundant, and if not removed so that the nourishment is taken from the trees a chestnut forest is undoubtedly one of the most profitable. It makes no difference how stony the soil is if it is broken up, and if below there lies a sandy clay.

The stumps produce plenty of sprout timber which is valuable for fencing. For the production of a good saw-log sprout timber of any kind is very inferior to that grown from the seed. The latter only gives us good and durable lumber.

In order to cultivate chestnuts the nuts should be kept safe over winter and planted in spring. If planted in fall the danger of being discovered and devoured by forest animals is greater than apparent. The little striped ground squirrel and its larger brothers, the red, gray and black squirrel, as well as forest mice, will find a chestnut under the soil, dig it out and carry it to their winter quarters.



I have kept chestnuts over winter in perfect condition in boxes with both top and bottom removed. I dig it about six or eight inches in the ground and lay sod in the bottom, on which I place the chestnuts mixed with a little sand. When the box is full to within about four inches, I cover the nuts again with sod, pour plenty of water over them and cover the whole with bricks or pieces of bricks so tight that mice cannot get at them. If there is any danger of being discovered by rats or mice, the nuts, before they are placed in the box, may be covered with a thin mixture of tar and coal oil. Nothing will touch them if thus put away.

The chestnut sprouts very early in spring, and if the time is not observed very closely the germ will push so rapidly that it will be difficult to plant the nut. For this reason they should be taken from their winter quarters when frost is still in the soil and kept in a cool place where they can be seen every day, and they should be planted as soon as possible.

The young chestnut sprout is very sensitive to the hot rays of the sun in June, July and August, consequently they must be protected if the young plants are raised in seed beds. Two small boards should be nailed together and hung on little pegs stuck in the drills. On hot days these must be put on about nine or ten o'clock in the morning and ought to be removed towards evening.

If a seed-bed of twelve feet wide and twenty-two feet long is taken, and drills made six inches apart, and there is put in every foot of drill eight chestnuts, there can be raised on this little piece of ground in a garden, which is not a square perch, four thousand two hundred and twenty-four chestnut plants, or seedlings enough to plant two or three acres. These may be transplanted in the following spring, at a distance of from three and one-half to five feet apart. On poor soil the distance should be smaller and on good soil larger.

CHESTNUT OAK—(*Quercus Prinus*, L.).

BLACK OAK—(*Quercus tinctoria*, Bartram).

These forest trees are found nearly everywhere on inferior soil; on mountain plateaus, as well as on southern and northern mountain slopes; on gravelly and stony soil. They are found on soil composed of sandy clay, and if it is composed of two parts sand, the trees are but partly well developed. When they reach a height of thirty or forty feet they have generally finished their growth, and will commence to increase in thickness. Generally they are checked by forest fires; and where the soil is overrun every few years with fire and deprived more and more of organic matter, the trees always remain stunted.

The chestnut oak is a rapid grower on middling good soil, and keeps up well with the chestnut. It is a valuable tree on account of its tan-bark. The timber is used principally for railway ties.

White oak and chestnut oak ought to receive more attention in forestry, while the other species, such as black, red and pin oak are of less value.

BEECH—(*Fagus ferruginea*, Aiton).

This beautiful tree is always found where the soil is a light, sandy loam. It prefers eastern exposures. A soil roughly covered with broken rocks will not hinder its good development in the least, if the under ground is of the above quality. Wet soil and tough clay must be avoided in the cultivation of beech. If the soil is half or even two thirds sand and one-third clay it is suitable. If accompanied with

the larch (*Larix*), both do better. Wherever beech grows the larch does well also. It appears that both assist each other in thrift and produce an excellent and very handsome and valuable forest.

It cannot be expected that large areas of these two forest trees should be raised since small tracts of land only are adapted to its growth, but wherever a hilly country is exposed to the east they should be cultivated.

Beech nuts should be gathered in fall and kept over winter in boxes packed with moist sand in a cool cellar. Here they must be protected against rats and mice. They should be sown in spring in little spots six inches large, made with a hoe. From three to five seeds are sown and lightly covered, but pressed down well with the foot. The seedling spots are made from three to five feet apart.

Larch seed must be obtained from seed firms.

ALDER—(*Alnus incana*).

This tree is always found on moist and wet soil. In the driest season it can always be relied upon to prove that wherever on the mountains the alder is found, water is underneath within a short distance. On high elevations it is a bush only, keeping its dark green leaves till late in fall, while along river and creek bottoms it can be cultivated in fifteen years to become a valuable tree.

The alder wants plenty of moisture, and is regardless as to the quality of soil. If this is sand only and a little mixed with organic matter the tree will thrive well. For a good and quick growth it requires grass underneath. Consequently if alder is to be cultivated, grass and hay seed must be sown first, if not already present. With the grass the alder seed should be sown and a little of it raked or pressed down. It will soon show its leaves.

The alder is very well adapted to pastures. It appears that it assists the growth of grass, and the wood being very bitter, cattle will not eat of it. To grow alder seedlings the seed should be sown in drills in seed-beds. The little plants may be transplanted at distances from three to five feet in one, two or three years. On soil which is rather too wet, they may be planted on top of the soil. The roots should be covered and pressed down well.

The seed is obtained by picking the little cones when they become yellow. Frost will open the scales and the seed then drops out. It should be preserved in moist sand in a cool cellar. One pound contains about two hundred and fifty thousand seeds which will germinate.

BIRCH—(*Betula*).

There are seven distinct species of this forest tree. The black birch inhabits our mountains, while the white birch is always found along water courses. The black birch may be found on the poorest soil, but is not well developed. To cultivate a fine forest of birch, it requires soil which is composed of three parts of sand and one of clay. As soon as sand disappears and the soil becomes clayish it will not grow. Birch grows better on northern than on southern exposures. The soil may be covered with broken rocks and stones without hindrance to its growth. If blended with the yellow pine, both will develop better. The annual deposits of fir and leaves appear to influence both very favorably, and both are satisfied with the poorest mountain soils where no other forest tree can exist.

The seed ripens in September. The little cones should be stripped from the branches, and placed on a tight floor in a cool room. When



the scales open they should be beaten with sticks, when the seed will drop out. They may be kept over winter either sifted or mixed with the broken scales in moist sand in a cellar. They should be sown in spring in little spots made with the hoe. Seedlings are raised in drills in seed-beds. They may be transplanted when one, two or three years old. One pound contains about three or four hundred thousand seeds.

WILLOW—BASKET WILLOW—(*Salix viminalis*, L).

This tree is only found where the soil is moist. Along water courses they are always found and they prefer running water. In swamp or stagnant water they remain stunted and never develop to a desirable size.

There is not one of our forest trees from which a profit can be realized in so short time as the willow. In our state there is hardly a farm to be found where a few thousand willows might not be cultivated and on such soil and in such places as are otherwise useless to the owner.

The willow grows in any soil if moist enough. No matter whether the soil is sand or sandy clay or all clay, if only a little sand is used in the plant-hole where the cutting is inserted.

Many of our farmers allow little streams to run through their meadows as their grandfathers did, never thinking of utilizing the water to their profit. I have had plenty of opportunity to observe places where small streams wind their way through a meadow of perhaps four hundred yards in length, in more than twenty unsightly curves, making the stream six or seven hundred yards long. In these cases owners should make the creek straight and bank up the sides with stones, etc., planting basket willows along the water's edge, and giving each willow a distance of four feet on both sides. The willow roots never overrun the adjoining ground if planted deep enough, or in the water's edge. The roots run to the moisture, which is not found on the surface.

Willow cuttings should be planted in the following manner:

A half-inch pointed iron or steel rod is driven into the soil or near the water's edge, at a slant of about fifteen degrees, so deep that three buds may be placed in the soil and two above. The cutting is pressed down well, whether under water or on the ground and air must be excluded. If planted at the water's edge, it is best, as water naturally excludes air.

If the two buds grow one is removed close to the bark. The stronger remains. This is trained to the height of six or seven feet, but care must be taken that any small side branches are cut away with a sharp pocket knife during the first summer.

The object is, to bring the main stem (head) so high that grazing cattle cannot reach it. As soon as this height is obtained, the willows are headed. This means, that the top is cut off, so that the young sapling is compelled to form a head which produces the annual crop of sprouts used so extensively in our country. The sprouts are cut early in spring, tied into bundles and stood erect in running water. When the buds show a sign of sprouting the bark can easily be removed and they are ready for the market.

THE HAZEL—(*Corylus avellana*).

The hazel is hardly counted as a forest tree as it is a mere nut-bearing bush, but who ever has observed it closer, thinks differently. There is scarcely a forest plant which is a greater improver of the soil than

this little tree. It will grow where any other tree may barely keep green. On dry stony sandy soil the hazel grows and bears nuts. It improves the immediate standpoint very much in a few years by the fall of its abundant leaves, and accumulates plenty of organic matter for future growth.

For this reason it is a warm friend to the forester who has to battle against barren soils.

Where the soil is of a deeper sandy loam the hazel comes to perfection in a short time, but where the soil is poor from one hundred to two hundred should be planted at regular distances between the forest trees. They give an annual crop of fine wood, used for hoops, etc., as well as a good crop of nuts.

Hazel may be raised with cuttings, but I prefer the planting of the nut. They should be procured in fall when fresh gathered and preserved the same as hickory nuts. The filbert nut is to be preferred.

There are many more deciduous forest trees of less value. The time may come when these will receive more attention. For the present we will have enough to attend to if we start the cultivation of those mentioned above.

## II. Evergreen Forest Trees—(Coniferes).

It appears that nature has selected the fir trees to shade the soil and maintain moisture. This is sufficient reason that these trees should receive far more attention than the deciduous ones. A great deal could be said regarding the carelessness of us all in not assisting nature in the renewal of pine forests—but the "milk is spilled," and crying is of no use. Energy, an iron will, a little money and plenty of work will remedy matters in this direction very effectively.

THE YELLOW OR PITCH PINE—(*Pinus rigida*).

This tree is found in all situations from the high and dry mountains down to the fertile valleys. Even if the soil on our extensive mountain regions—as for instance, the Allegheny, Blue-Second and Broad mountain—should be ever so poor and almost barren, the yellow pine would grow well. If it has only two or three feet of sandy soil, or if the soil should be all sand, the pine will develop into a fine tree in time. The only soil not favorable to its cultivation is tough and hard yellow or blue clay. Here, if it grows at all, it will remain in a stunted condition. This kind of pine is the only one provided with a tap or center root, consequently it requires some soil in which to fasten itself. For this reason it is easily seen that transplanting a yellow pine seedling is rather difficult for the young tender plant must not be injured in the least. The top root must be planted its full length, so that it may stand somewhat deeper afterwards. The soil must be so compact and moist, and, at the same time loose, that an insertion may be made deep enough to receive the tap-root its full length. For the reason that this peculiar root descends in the first year as much as the soil permits it must be transplanted as a forest tree—always when one year old. Transplanting of yellow pine may be done only where the soil presents the above condition. As regards seeding, it may be said that no matter where a few grains are dropped, if lightly covered and pressed down well, the germ will always push its way through.

In my extensive travels throughout the anthracite coal region where heavy timber teams have made roads on the conglomerate gravel soil, I have found that where such roads are abandoned for a number of



years the young yellow pine grows and thrives in great numbers. The wagon ruts prevents the fire from burning them. The soil on these roads is made so hard by the steady travel of mules that it would seem impossible for any kind of seed to sprout, but yellow pine seed will thrive under such conditions.

From these observations I reached the conclusion many years ago that these almost worthless lands might be reclaimed by seeding in places three or four feet apart, and by protecting them from forest fires. With seeding and proper guarding these extensive mountains might all be under timber again in less than ten years, thereby sheltering the soil and retaining moisture.

The yellow pine blooms in spring and the seeds ripen in eighteen months afterwards. Where the timber is felled seed may be obtained by picking the cones from November till February. The little pine squirrel is in constant search for them. For this reason I would advise that the cones be picked in November and December before the sun opens the scales. They should then be spread on a tight floor and exposed for a few days in a room of which the temperature is about fifty degrees.

One bushel of cones contains about sixty thousand seeds or one pound.

I have experimented with the European yellow pine seed and have found that it grows here better than the seed from our native tree. For this reason I advise those interested to import this seed.

THE HEMLOCK—(*Tsuga Canadensis*).

This lovely tree inhabits principally the northern exposures of our mountains. If between the broken rock beds the seed can find soil enough for germinating the young hemlock will grow. Oftentimes this is impossible and the abundant annual fall of seed is lost. On mountain plateaus which are not exposed to the south the hemlock does well, not however as a predominant forest tree, but sprinkled in amongst others. On wet soil and on tough clay the hemlock never comes to perfection and in such places is often top-killed. The extensive northern mountain slopes which are more or less covered with rocks and stones, are, as a soil for general cultivation, almost worthless, but for the growth of hemlock they are most excellent.

The hemlock produces abundant seed almost every year. It blooms in spring and the little cones drop the seeds in September and October; and where it grows any quantity of seed may be procured.

The timber is hard, tough and durable from its infancy, but the hemlock is a slow grower, which is a drawback in its cultivation. Very closely related to this is the

NORWAY SPRUCE—(*Abies excelsa*).

It is of the same nature as the hemlock and its cultivation should be the same. The seed must be procured from seed firms and ought not to be more than one year old.

As it is not a native here the only good way to secure good, fresh seed is to order it early enough, direct from European seed firms. The hemlock, as well the Norway spruce, is in its infancy, and when but a small tender plant, very sensitive to the rays of the sun. For this reason the seed should be sown only where it may be protected from the sun. Such places as the north side of an old stump between its roots, or on the north side of a stone, or anything else that will shelter the young plant will do.

The planting of two, three or even four year old plants is to be pre-

ferred wherever planting can be done. The seed should be sown thickly in drills, in good soil, with a good top dressing of sod ashes, and only covered to the thickness of the seed, and pressed down firmly. They must be sheltered during the hot hours of a sunny day, or they will be killed, oftentimes by the hundred thousand in a few hours, under a scorching sun.

In good soil they may be transplanted in two or three years to the number of about twenty-five hundred per acre. In poor soil single planting is not advisable. In such case the Norway spruce must improve the soil, consequently another method is adopted, viz :

#### *Bunch Planting.*

This name explains itself. The seed is sown in drills very thickly, and in order to obtain bunches, from six to eight seeds are sown on a very little space containing about three or four square inches. In two or three years many thousand such bunches may be raised. They are transplanted in plant-holes from three to four feet apart. No bunch ought to contain more than five nor less than three plants.

In Germany I have assisted in planting large tracts with bunches and these cultivations never failed to give the fullest satisfaction even on the poorest soil.

When it is seen that the young forest becomes too dense, the inferior ones must be removed, but never so that bare spots are made.

If forests, principally evergreens, are allowed to grow up too dense, the result is generally disastrous. There is then such a net-work of roots that these cannot develop properly. All the trees strive for air and light, but their number is so great that more than one-half perish in the struggle. Such forests suffer greatly from the pressure of snow and ice. I have seen acres of young hemlock bent by snow which never regained a straight standing. If the roots are strong enough to bear the trunk and the soil is shaded, snow and ice weights very seldom injure a forest.

The correct rule is, keep the soil shaded and remove the inferior trees to give those remaining more room in and above the ground.

THE WHITE PINE—(*Pinus Strobus*).

This pine is found scattered in all situations from the high mountains down to the fertile valleys. It requires a light, sandy clay. Stony soils or stones to the depth of two or three feet are favorable to its cultivation. In company with the yellow pine it thrives splendidly. Both assist each other in improving the soil. Old abandoned fields are most excellent for seeding with white pine and yellow pine mixed. Poor, hilly soil, which has not been deprived entirely of organic matter, may be seeded with these two kinds of pines and in time such otherwise worthless lands will become valuable again.

The white pine blooms in spring and the seeds ripen in sixteen months afterwards. Where such trees are felled it is no trouble to pick the cones from the treep tops. If this cannot be done it must be ordered six months in advance from seed firms. Seeding is done by having little spots at every three or four feet, and three or five seeds should be dropped in and pressed down well. If yellow pine is mixed, which is always advisable, the seed of the different kinds must not be mixed in the same hill. Every row or seed place must receive its own seed.

About one hundred years must elapse before a valuable saw log



may be produced from a white pine. The wood remains soft and brittle till it reaches this age.

THE LARCH—(*Larix*.)

This valuable and fast-growing tree cannot be successfully cultivated in large forests. It requires eastern exposures and soil which is composed of at least one-half sand. If the soil should contain even more sand and less clay it is still favorable. Larch grows well in climates colder than that of this state. Very extensive larch forests are found in Siberia. On soil where beech is found the larch may be cultivated with certainty of success. In the first fifteen or twenty years it grows very rapidly and it sometimes seems that the larch might suffocate all other trees in its vicinity, but in time their growth is equalized. Larch may be mixed with yellow pine, Norway spruce or white pine in connection with beech, but it should be placed in separate rows or planting spots.

The larch is a very fast grower and the timber is of a fine hard quality, rarely attacked by insects. Consequently it ought to be cultivated in connection with all our other forest trees wherever the soil is favorable. In fifty years the larch will produce the finest building lumber of any of the conifers.

It is said, that larch piles were used by the citizens of Rome a thousand years ago, which are still sound and good.

Seed must be obtained and ordered six months in advance from reliable seed firms.

*Testing of Conifer Seeds.*

I have mentioned before that there is nothing more provoking in forestry, than the sowing of useless seed, and it is particularly so with the evergreen. Consequently I will give those interested my experience in selecting good seed.

Any quantity, no matter how small or large, ought to be ordered at least six or eight months before it is received. If a few dollars are sent in connection with the order, it is all the better. The seed firm sees that you mean business. Bind them down to the fact that you only want fresh and good seed, and that you will return the bad at their expense. It will pay you to give a few cents more for a pound of good seed. Conifer seeds, with the exception of larch, perhaps, are useless when more than one year old.

Good yellow pine, hemlock, Norway spruce, and white pine must show a nice, full, white kernel. When crushed under the thumb nail the seed must offer good resistance and show a small quantity of oily matter. Every person who tests seeds ought to provide himself with a little magnifying glass at a cost of about thirty-five cents. This will show whether the seed is good or not. If the kernel is yellow, or has a yellowish tint only, it is useless. The oily matter has become rancid and the germ is surely killed.

Another way to test it is this: A number, say perhaps fifty or eighty, may be taken from a quantity of seed and planted in a flower pot, and exposed to the warmth of a room. If in two or three weeks seventy per cent. germinate, the seed is very good, if fifty per cent. grow, the seed is good, if thirty, it may be pronounced middling, but if only fifteen or ten per cent. germinate, the seed is inferior but still it is useful.

It must be borne in mind that the seed in the flower pot has double the chance to germinate over that in open nature.

Yellow pine seed must have a dark brown color, nearly black.

Norway spruce is light coffee brown,

White pine and larch are of a yellowish brown color. When a handful is taken it should feel weighty in the hand.

When all these seeds are soaked over night in water and a large quantity swims on the surface in the morning it is not a sign that the light seeds are useless, but they should be sown in separate seed-beds in order to ascertain the result.

In conclusion I will say that there is no doubt that many of our farmers would become owners of small yellow pine, larch or Norway spruce forests, if they knew the value of a few pounds of these seeds, and if they knew how to go on with practical forestry.

THE TIMBER QUESTION AND WHAT TREES TO PLANT.

By E. SATTERTHWAIT, *Jenkintown, Pa.*

[Taken from the annual report of 1887].

The subject, or rather, science of forestry, as it may properly be called, has of late justly claimed a large share of attention from agricultural and climatic scientists. But notwithstanding so much has been said and written on the subject, its importance is not likely to be overestimated. And though, probably, there is not much that the deliberations of this body can do in the direction of accomplishing the great results that are confidently claimed as being within its scope, it may not be out of place to give it a small share of our attention. The value of timber, considered merely as a commercial product, is beyond all calculation, and is probably greater than that of any other one thing that could be named. But when we come to consider that besides this, upon the question of timber or no timber, depends in a great measure the value of all the land in the country for the purposes of agriculture, and that without trees a very large portion of our country must become a desert waste; that questions of climate, of extremes of heat and cold, of destructive atmospheric disturbances, of uniformity and regular distribution of rainfall, of the supply of well water and of the flow of springs, and even of large streams and navigable waters are dependent largely on this question, we see at once that it is one of too great importance for any mere State institution or State Legislature to cope with. And it is a source of gratification to know that our National Legislature has done something, if only a small beginning, in the direction of advancing this science. And perhaps the most we can expect to accomplish will be, by agitating the subject, to compel our representatives in the National Legislature to recognize its importance. I do not profess to speak as an expert, having given only a little casual attention to the subject, and it is in reality a great science, one in which a lifetime could profitably be spent, but judging from my own observations and the opinions of those who have thus devoted their lives to its study, I am firmly assured that it is a subject more deserving the attention of our government than some others that now claim a large share of the national resources. With an annual appropriation commensurate with its importance, hundreds of millions of acres of territory now condemned as an irreclaimable desert and almost unfit for any agricultural purpose, could, with a comparative small expenditure in the planting and caring for



forests, be reclaimed and become a valuable part of the public domain instead of a barren waste. This subject is surely one of sufficient importance of itself to justify the agriculturists of the country in demanding that their interests shall be recognized by establishing an agricultural department with a cabinet officer at its head. It would be out of place here to pursue further this branch of the subject; but it may perhaps be well in treating of the general subject of tree planting to give a few of the general conclusions which seem to be indisputably established. One of the most important of these is the effect that forests undoubtedly exercise on the amount and distribution of rainfall. This is easily understood when we reflect that rain is the condensed vapor that has escaped by evaporation from the earth's surface and that the amount of rainfall is of course limited by the amount of evaporation. The effect of an area of forest on evaporation is precisely similar to that of a body of water. The tendency of both is to modify and equalize the amount of evaporation. The absorption of moisture by the atmosphere from a surface of water or of forest is uniform; that is, when the conditions are the same. Whereas the amount of evaporation from ground not so covered, is extremely variable. When the earth is wet, the heat of the sun during the warm seasons of the year, when vegetation is growing, causes a rapid vaporation from its surface, probably much greater than from either a surface of forest or of water. But when, on the other hand, the earth happens to become dry, evaporation from its surface falls off in proportion and in times of extreme drought, the escape of moisture from the earth, even under the hottest sun will not be equal to the amount nightly extracted from the atmosphere in the shape of dew, so that the expression, at such times, that "it has got too dry to rain," is quite correct. We can thus readily understand how, in a country where there are no forests, and far from any large bodies of water, rain becomes impossible and no form of vegetable life can exist. This explains how deserts are formed. Now let us see how this will apply to a country, as ours is, diversified with cultivated farms, forests and streams of water. During winter and the cool months of spring and autumn, when not much rain is needed for the purposes of vegetation, we have generally an abundance. But when the summer heat begins it may, and generally does happen, that in some sections, the surface of the ground having dried quickly, a drought commences, and in a little while the whole surface of exposed soil affords so little moisture to the atmosphere that rain would not be possible, but that there are some areas, not too far removed, covered either with trees or with water, where evaporation still goes on. And so it very commonly happens that our summer local rains, upon which we have to depend so much for success in all our farming operations, most provokingly seem to shun the driest sections. The reason is, there is not enough moisture in the atmosphere in those sections to produce rain clouds. The whole subject is very simple when we come to look at it. The atmosphere absorbs moisture like a sponge and like other substances it expands with heat and contracts with cold, and when any portion of the atmosphere is suddenly cooled, as by coming in contact with a colder current of air, the contraction thus caused squeezes out the water, and this is rain. But if the atmosphere has been in contact with only dry earth it will not contain sufficient moisture to produce rain—the sponge will be too dry. Where a large portion of the earth's surface is covered with forests or bodies of water, the evaporation

from these being constant, there is mostly a sufficient amount of moisture in the atmosphere to produce rain when other favorable conditions occur.

That the quantity of vapor given out by trees when in leaf is very great, is made evident by cutting off and exposing to the sun a branch with foliage in a hot summer's day, and see how quickly all the moisture in the leaves will be absorbed by the air. And this absorption is going on continuously during the day, from the whole surface of every leaf in the forest. During the hot summer day, every growing tree is drawing up a constant stream of water from the earth, and giving it out to the surrounding atmosphere where it is held as in a reservoir for future rainfall.

The comparative amount of water thus given out to the air between a surface of forest, a surface of water, and a surface of bare earth, or one covered with growing crops, I have no means of knowing, nor am I aware that any attempts have been made to solve this very interesting and important question, but I should think it highly probable that the evaporation from forests, when we consider the immense surface of leaves exposed, every pore of which is constantly giving out particles of water during the day, must be far greater than from a surface of water. Fields of grass and grain and all other forms of vegetation, of course, are constantly giving out moisture through the day in clear weather, the same as trees, and in proportion to the amount of leaf surface exposed. Probably the greatest amount of evaporation from any surface is from that of moist earth. But the trouble with this, as well as with fields only partially covered with growing crops, is, that all moisture from the surface is so quickly dried out, and then evaporation nearly ceases; whereas, from a surface of forest or water, evaporation is the same at all times, under the same conditions. And thus it is that in regions devoid of these in times of drought, rain becomes an impossibility, until the occurrence of some widely extended atmospheric disturbance may bring rain clouds from a distance. If all our cultivated fields could be kept covered during summer with growing vegetation, this would probably do away with the necessity of forests to promote rainfall. But the trouble is, that when a drought commences, all the grass fields begin to lose their green covering, and in a little while present only an arid surface, from which evaporation almost ceases. Now, while this is so plain that it might be supposed to be familiar to every one who has given the subject a thought, yet it is to be feared that if generally understood, its importance is certainly not appreciated. I have only mentioned one of the beneficial climatic influences produced by forests. There are several others that might be mentioned that are more or less important. But all are so easily explained and should be so well understood as not to need mention here. It being conceded then, that forests exercise a most potent beneficial influence to all agricultural pursuits, in the promotion and distribution of rainfall, in the preventing of the drying up of springs and wells, in affording barriers against inclement and destructive winds, and in many other ways exercise a most important beneficial climatic influence, it becomes a question worthy of most serious consideration how to promote an interest in their culture and extension and arrest the imminent danger of their almost total extinction from a large proportion of our country. It is not enough to prove the great public advantage of a work like this. Men will not spend their time and money to any great extent for the public benefit. There must be some



individual inducement, some hope of personal gain to accomplish much in that direction.

As to what might be done by State legislative enactment, I will not undertake to advise, as I confess to not have given the subject much thought. Very much, I believe, has already been accomplished in some States, and some little in our own, which might perhaps be followed by more important and effective measures. The exemption of forest lands, to a certain extent, from taxation, might perhaps be well, and surely some effort should be made to have our forests better protected from railroad and other fires, which are now destroying them faster than all other causes combined. I find I have already taken up so much of your time that I shall not have much space to devote to what I had chiefly in view when I commenced this paper, that is, to try to interest farmers in planting trees for their own benefit.

The love of trees for their own sake, for their natural beauty, for the pure and unalloyed pleasure to be obtained from their culture, in watching their growth and development from year to year, in the enjoyment of their healthful and delicious fruits, their grateful shade in summer and protection from the piercing winds of winter. These should be enough of themselves to inspire the natural instincts of every well regulated mind to become interested in tree culture, and surely there cannot be the owner of a farm but who feels an interest in this subject. With very many, however, the interest felt is not sufficient to induce any great sacrifice of time or means, and many of these are more indifferent to the subject than they otherwise would be from not knowing what and where to plant. It is to these I would speak, and this is indeed a most important question connected with this subject, and one not always easy to answer. I will not undertake to do this for all, but will only try to throw some light on the subject.

I think every one will agree with me that a farm, entirely destitute of trees, would be a most dreary, forlorn and undesirable place for a human habitation. The first thing to be considered when we come to provide for this deficiency is, for what purpose do we want trees? Aside from their general and public usefulness in matters pertaining to the climate and public health, these are for their fruit, for shade, for adornment, for protection from inclement winds, for fuel and for timber, and in this last I include fencing and all the many other important and indispensable purposes for which wood is used. The first of these topics, fruit trees, I do not propose to treat of here, as I have elsewhere frequently given my views on this subject, and to do it justice would require a paper of itself longer than would be admissible here. On this head I will only say here what I have long been trying to inculcate, that no farm should be without a fruit garden of at least an acre, devoted to the culture of all kinds of fruit and vegetables. This, if properly managed and worked with the plow and horse cultivator, need not require much more care and attention than that much corn, and if proper judgment has been exercised in the selection of varieties, it will afford a profusion of fruits and vegetables for the home supply, and some to spare, with less labor than is commonly bestowed on the small kitchen garden, which affords but a very meager supply.

A few shade trees are essential about the house and buildings. For this purpose, some of the varieties of maples are most frequently

used. Of these the Norway is perhaps the most ornamental, as its growth is very compact and symmetrical. The sugar maple is a taller growing and handsome shaped tree. The silver maple is a much faster growing tree than either of these, but does not grow compact, and should be headed back occasionally to make a handsome shaped tree. Where a very fast growing tree is wanted, the Carolina poplar or cottonwood is now much planted. This also requires to be headed back every few years. Perhaps the handsomest of all shade trees is the weeping willow, which is also a rapid grower, but it is objectionable about a house on account of always dropping, either its leaves or small twigs. A few evergreens are indispensable about the farm buildings. Besides being essential as wind brakes, they are quite ornamental in winter, and add greatly to the beauty of the landscape when all other green things have disappeared. A belt of these should always be planted so as to protect the house and grounds adjoining from the north and west winds. They should not, however, be planted very close to the house, as their shade there in winter is not desirable. The very best evergreen for this latitude is the Norway spruce. This so completely fills the bill that it seems hardly worth while to mention any others, though there are scores of them to be found in the nursery catalogues. Though none of them are as good in every respect as the Norway spruce, yet for the sake of variety, in a large place, a few others might be admitted. The Austrian pine is a good hardy evergreen, but rather coarse in appearance, and only adapted to a very large lawn. There are a few of the other pines, and some of the arbor vitæ that are hardy, and some of these make handsome ornamental trees, and are useful where variety is wanted, but, by far the greater part of the evergreens named in tree catalogues are not adapted to our climate, and are worthless comparatively here. For an evergreen hedge, or screen, our native hemlock spruce is perhaps the best. There are quite a number of fruit and nut-bearing trees, which, though not adapted to the fruit garden, are worth having for their fruit, and some of these are just as good for shade and ornament as the worthless maples and other shade trees that are commonly planted about the house and lawn. Some of the fine varieties of our native chestnuts are quite valuable for their fruit, and make as good a shade tree as any other for planting about the farm buildings. They do not graft as easily as most fruit trees, but it can be done. The English walnut is not an unsightly tree, and is fast growing and bears a very desirable fruit. They should be grafted with a good bearing sort, but it requires an expert to do this. The sweet cherries that do not thrive so well in the fruit garden are fast growing and well adapted for a shade tree. Our native persimmon I consider well worth a place in the lawn. I have some varieties of them that ripen very early in the fall, and I know of no more delicious fruit. They are easily grafted. The Japanese persimmon is an extraordinary fine fruit, but will not stand the winter here. There are some of our native black walnuts with very thin shells full of meat that are well worth planting; but the black walnut is very poisonous to most other vegetation, and should only be planted in a meadow where nothing but grass is to be grown. They are very hard to graft. The mulberry is a fruit not to be despised, and I consider it worth a place in the lawn. Amongst the many varieties of our native plums that have been lately introduced, there are some that are very productive, and the fruit is quite useful as well as ornamental. They are well worth



a place about the farm yard or lawn, as are also a number of the newer varieties of the Chinese and Japanese pears. In fact, there are so many kinds of fruit and nut-bearing trees that are as valuable for shade and ornament as the worthless kind commonly planted, that it seems hardly worth while for the farmer to plant any others for these purposes, except the indispensable evergreens, and it may be a few shrubs and other small trees for ornament. For the purposes of wind brakes, as well as for shade and their valuable fruit, I would plant along every lane and roadway on the farm, some fine variety of chestnut. The advantage of these as wind brakes in winter, and for shade in summer, will more than compensate for the loss in farm crops from the harm done by their roots, and if grafted trees of the best variety are planted, their fruit will repay many times over all their cost.

We now come to the subject of planting purposely for fuel and for timber. If all, or nearly all, the native forest has been stripped from the farm, this should be considered an absolute necessity. But I shall be compelled to treat this very important branch of my subject very briefly.

In determining the question whether any, or how much, of the farm could be profitably devoted to this purpose, there are several important considerations to be taken into account. Where land is very valuable for farming purposes, and coal a reasonable price, it may not be advisable to set apart any ground especially for fuel or timber. A few rows of chestnuts along the lane and roadsides or boundary of the farm, as I have suggested, will soon afford sufficient fencing timber. It may be thought, that in this country where timber is still so abundant, that the time has not yet come for practical foresting, but I am well persuaded that I could give no better advice to the farmers of this State than to give this subject their serious attention. There are few farms but could profitably spare a small part for timber purposes, and on very many a considerable portion could be used to no better advantage. Ground the least fitted for farming will commonly answer well for growing timber if judiciously planted. A steep hillside, an irreclaimable ravine, a soil so full of rocks as to forbid satisfactory cultivation, can be made to produce a valuable crop of trees. Where ground of this character is already forested, it would, in most cases, be extreme folly to clear it for farming. Very commonly the value of timber can be greatly enhanced where the native forest has been cut and left to renew itself, by cutting out the most worthless sorts and planting valuable timber trees in their places. This would not be an expensive work, as trees so planted grow well without further care.

The first consideration in planting is, of course, in determining what kinds to plant. As to that, I will not, as I have said, speak for any but that section of country that I am familiar with; I mean south-eastern Pennsylvania. For that I know of no timber tree that possesses so many valuable properties, especially for the purposes of the farm, as our native chestnut. It is of very rapid growth. It will grow and thrive on the poorest soil. For fence timber I know of nothing to compare with it. It lasts longer for posts than almost any other that we have, and splits freely into rails, which will last almost a century. When fresh cut it is so soft and easy to work that I well remember how I used to consider it fun rather than work to go into the woods and cut and work up chestnut into fence posts and rails

Though the wood of the chestnut is so soft, when green, it becomes sufficiently hard when seasoned, and will take a high polish, and is much used as an ornamental wood. Perhaps its most valuable property is that the sap wood is as durable as any part, and on that account it makes the best of fence posts as soon as large enough, and the branches and young wood are very valuable on the farm for bean poles and other stakes. It also makes good fire wood, never decaying or becoming worm-eaten and worthless for fuel as most other wood does if left long exposed to the weather. Another valuable property of the chestnut is, that when cut, it sprouts up at once from the stump and soon re-forests the ground with the most valuable of timber. Though I have found no timber tree so valuable as the chestnut for my immediate locality, I would not discourage the planting of others that might prove even more valuable elsewhere. The locust makes a more lasting fence post, and if it were not so liable to be utterly ruined and destroyed by the borer, I would recommend a small plantation of it on every farm. There may be some locations yet where it will do. The most durable wood for posts that I have had any experience with is our native mulberry. But whether it would amount to anything as a forest or timber tree, if planted and cared for as such, I do not know, but should think it well worth trying. The black walnut is a very valuable timber tree, and grows very rapidly in a rich, deep soil. And where such ground is not worth too much for other purposes, a plantation of them would be a profitable investment. The most valuable wood for fuel is the shellbark hickory, and where wood has to be depended on for this purpose, these should be planted. It is a very valuable wood also for other purposes, and grows fast in a rich, moist soil. In many locations it would pay to grow it. The oaks take too long to mature, and on that account cannot be recommended for planting. It is only the heart wood of the white oak that is durable, and it takes at least a century for one to get large enough to be of much account. There are, of course, many other trees valuable for fuel and for timber, such as the ash, the elm, the maple, the beech, the sycamore and others. And some that I have not mentioned might prove more profitable in some localities than those I have recommended. It is with timber trees, no doubt, as we find it to be with fruits—those that do best in one location will not thrive at all in another, even where no essential difference in soil or climate is apparent. And it will be well for any one about to plant to use his own judgment in determining this question. I have only attempted to throw out some hints that might, perhaps, be useful, and I wish it always understood that I am speaking to farmers who may be supposed to wish to plant only for some purpose of practical utility. The landscape gardener and the wealthy landowner, who desires trees in great variety for ornamenting and beautifying his grounds, will, of course, seek for information in the many books that have been published on the subject, and the innumerable tree catalogues that everywhere abound; my object here is solely to try to induce farmers to look into this matter and give it the attention that its importance calls for, and if we can succeed in this I feel sure that a great step will be gained in the solution of this momentous question.

It may be thought strange that I have entirely omitted saying anything upon what is undoubtedly the most important phase of the "timber question" in this State—the imminent danger of the almost total destruction of the timber in the vast lumber regions, comprising



the mountain districts of the State, and the consequent extinguishment of one of our great sources of wealth.

This branch of the question has been so often and so ably brought to the attention of our people by those who have had much better opportunities of studying the subject, that I thought it best to confine myself to a few points of minor importance, but which were more within the scope of my own observation.

I feel that I ought not to close this paper without at least alluding to the praiseworthy efforts on behalf of forest protection and extension by a few public-spirited citizens of our State, in the formation of an association to promote the objects, and I cannot do less than ask for the "Pennsylvania Forestry Association" the indorsement of this meeting and from our people all that aid and encouragement they can afford to so commendable a work.

#### SUGGESTIONS RELATING TO FORESTRY.

By PROF. W. A. BUCKHOUT, *State College, Pennsylvania.*

[Taken from the annual report of 1887.]

It is often said, to the reproach of those who advocate an interest in forestry, that they have nothing practical to offer or suggest, that they are mere alarmists painting in vivid colors the death and destruction which are to follow when our forests and our timber are gone, but that they totally fail when they undertake to devise practical means for averting the calamity which is to come. While I do not believe that the objection is well founded, it evidently behooves the advocates of forestry to step forward and present their case in as strong a light as possible. In brief, that case is this: The marvelous rapidity in the increase of our population, and the consequent demand for lumber and wood, for various purposes, are making such drafts upon our timber lands that it will not be long before the supply will be exhausted in all the old settled parts of the country. The natural process of reforestation is so slow and uncertain that but little value can be derived from it unless it is supplemented by the fostering care of man.

Beside their direct commercial value, forests are of marked benefit in that they are the most efficient conservators of our water supply that it is possible to have. I do not refer to the much-disputed questions of the effect which forests have upon the absolute amount of rain which falls, but to the protection which they give to our streams, and to the conservation of our water supply in its general sense. Regarding this I think there is no doubt.

If, then, forests have this double function of supplying one of the most useful of the raw productions of the country, and of regulating its water distribution, what can be done toward keeping them in the most serviceable condition?

There are two ways: First, to allow and encourage by care and attention a second growth of timber; and second, to plant trees in large numbers, in other words to raise a forest as one would raise any crop.

To both methods there are several difficulties, the chief of which are that trees at best grow so slowly that they can scarcely be compared with ordinary farm crops or even crops of fruit, and so long a

time is required before reaching a usable size, that they are subject to many and peculiar dangers; moreover there is a possibility that the ingenuity of man, and discoveries yet to be made, may make the forest products of much less value than they now are. This looking forward into the distant future (distant to us I mean) is not an easy matter, but it seems scarcely possible for the peculiar protective agency of forests to be supplied by any other means than by the forests themselves.

If, then, we grant that the probabilities are all in favor of the perpetual need of forests, what more can be done towards their production than nature is doing alone.

We find that as a very frequent rule second-growth trees are not of the same kind as the original; that a pine forest is succeeded by some less desirable species, and, moreover, the trees, whatever they are, are very often so few that they not only do not make rapid headway against the bushes and weeds, but that they tend to develop side limbs too much, and fail to make long, straight trunks, such as in later life will make the clear stuff, free from knots, which marks the best lumber; hence nature's process of re-forestation must be supplemented very much by man's effort. How practicable it may be to sow seeds of forest trees, or to transplant trees on a large scale, can never be known except by trial. There are some cases on record by which we can get a partial knowledge of results obtained within a limited time; not so complete as it is desirable to have, nor so conclusive; since, while they show unmistakably that forests can be raised by planting seeds or young trees, they do not satisfy us as to the best and cheapest methods for doing the work in mountainous regions like our own. It is not best to enter into consideration of these cases now, further than to say that they comprise planting under a considerable variety of conditions, in poor soil and in good soil, on shifting sands and on rocky hillsides, and in different parts of the country.

The few suggestions which I have to make are based chiefly upon observation of some cases of natural second-growth timber which is for some reason much better than the average.

It was twenty one years ago that I first saw a small tract of second-growth white pine on what we call the barrens in this county. I much regret that I did not then have sufficient forethought to measure the trees and make some estimate of the number upon a given area. I only remember that I was attracted by the vigor of the trees, their closeness, and the evident struggle which they were making with one another to see which would survive. They covered the ground to the exclusion of everything else; their trunks had already become divested of living branches below, and their tops made a canopy through which but little light fell.

At the present time this little tract still stands out in marked contrast to the mixed oak and pine about it. The trees are, of course, much fewer in number, but would still attract attention because of their symmetry, their closeness and the rapidity with which they are growing into first-class timber. They average sixty feet high. Their boles are clean of limbs below, and for quite a distance further there are no living limbs, only the remnant of dead ones which are slowly dropping to the ground. Where no cutting has been done they still stand remarkably close, averaging five to the square rod, and measures near the base eight to fifteen inches in diameter. They still shade the ground so completely that but little undergrowth of any kind is pos-



sible. But few trees have been cut except such as were under eight inches in diameter, and hence were nearly crowded out and could not have held their places much longer.

By counting the rings of growth, these trees appear to be about forty years old, and as this seems to correspond with the recollection of the few persons who know their history, I think we may assume that this is very near to their correct age. At the present time they appear to be making not more than a quarter of an inch a year, while in the first ten or fifteen years they sometimes made one-half of an inch a year. But I was not able to find live, fresh stumps, nor stumps of the largest trees, by which to get accurate figures of this kind. It is certain, however, that the present rate of growth is comparatively slow.

I have tried to have practical lumbermen give me the value per acre of this young timber, but on account of the small size of the trees, which unfits them for general use, the most that can be said is that it is growing in value all the while, and is worth more to hold than for present use; if used now it would cut very much to waste, and is suitable only for a few purposes. Forty years ago then, this small tract of land received a shower of white pine seed from some old trees—a single one of these trees some four feet in diameter is still standing, and numerous old stumps and logs attest to the presence of others. Favoring conditions permitted a very large number of these seeds to germinate, and probably the young trees stood not far from one to the square foot of ground at the time when they obtained sole possession. Having gained this one point, complete possession, they entered upon a race and a battle with one another, and that is still going on, and will not end until the axe or fire of the lumbermen sweep them away. Such cases as these ought to be of special value in teaching us that what nature does so successfully by her own unaided efforts may be done fully as well, and upon a much larger scale, where the intelligent efforts of man shall be added. Brought down to a practical suggestion, Pennsylvania has some thousands of acres of land which are poorly, if at all, adapted to cultivation, which are in various degrees of nudity and unproductiveness. Though once well forested, they have been stripped of all that was worth the handling and are now practically abandoned to nature. She does her best to cover their nakedness, but it is only here and there that it is done in just the way which most nearly meets man's necessity. Moreover, these lands, made up largely of our low mountain ridges, are so intercalated or even interlaced with the fertile arable lands through a very large part of the State, that we have the best possible relation between forested and cultivated areas. Happily, too, these mountain ridges offer little inducement to cultivation, and it is highly probable that in this wooded state they are efficient agents in equalizing our climate, as they certainly have been and are sources of wealth through their timber supply. It remains for us to see that the proper relation between our wooded and arable districts is maintained, and I wish to lay special emphasis upon the practicability of aiding nature to secure a thickly-set, vigorous stand of trees, whereby a greater number may be produced upon a given area, and such as will make the most valuable building material for use in the future. Herein is field for the labor of men with means and land, who are looking about for more worlds or woods to conquer. Amid numerous investments, why not make one, larger or smaller, in forest-planting?

A few words as to the objections which are generally given to such a novel suggestion. It will probably be said that much of this mountain land is so stony as to be totally unfit for any kind of vegetation, and that it would be impossible for trees to grow there. This is doubtless true of some places, but the areas of this kind are very much fewer and smaller than is generally supposed. I maintain that wherever it is possible to get trees started so as to make a slight shade and protection that there the accumulations of decaying leaves and branches and the disintegrations of the rocks will soon make a soil surface, thin perhaps, but thick enough to continue the life of the trees, and thickening as they grow. There is conclusive evidence that much of what is now the barren, shifting rock of our sandstone ridges was once covered with a very fair growth of trees, but upon their removal, or even without that, fire has swept in, and so thoroughly removed every vestige of organic matter that it will take a generation before any tree-growth can be established again. Further, it will be said that this danger from fire is so great and so constant that it renders any artificial planting on a large scale, and on our mountain lands, utterly impracticable. This is indeed the most formidable objection that can be raised. Anyone acquainted with the facts must be forced to admit its value. It is a cause of great regret when we consider that these destructive fires are so often originated by selfish and malicious persons. The only suggestion I can offer on this point is to express the hope that the popular sentiment which we all recognize as so powerful for good or for evil may be influenced by the press, by local clubs and granges, by such meetings as this, so that we shall soon be able to perceive a changed feeling, and that people will come to realize that forests have not only a value to the immediate owner, but also a common value and a common interest to us all.

Says Prof. Sargent in the census report on the forests of the United States; "Fires do not consume forests upon which a whole community is dependent for support, and methods for the continuance of such forests are soon found and put in execution." "The experience of Maine shows that where climatic conditions are favorable, the remnants of the original forest can be preserved, and new forests created as soon as the entire community finds forest preservation really essential to its material prosperity." If we accept the figures regarding forest fires in Pennsylvania by this same census report of 1880, we must admit that the room for improvement in this public sentiment is a very large room, for we are told that the property destroyed was valued at over three million dollars; that there were one hundred and twenty-nine destructive fires due to clearing land, one hundred and thirty-three to sparks from locomotives, seventeen to hunters, and (worst of all) one hundred and two to malice. May the efforts to bring about a better public sentiment in this respect be redoubled, until we shall no longer be compelled to record such humiliating facts as these. Still another objection arises in that the length of time required to get any return from money invested in planting and caring for trees is so great that few would be willing to run the risks. The difficulty, however, is rather in the feeling that it is not perfectly plain that at the expiration of a given time there will be value in the investment, and not that long time is required. The time is no longer than in some other business project, but this is to most men an entirely new idea. Many do not believe that forest trees can be grown as fruit trees in a nursery, or as ordinary field crops are grown.



There is a fallacious idea that forest trees so impoverish the soil on which they grow that a second crop of the same or similar kinds cannot be grown until some years have elapsed and the soil has been able to recuperate. Experimental plantations which would be of great service in showing what is possible in this direction are few and far between. For these and similar reasons men are slow to take stock in such an enterprise, although I apprehend there are some who would be willing to trade off some unproductive stock in more specious enterprises and run the risks in a forestry company. But what is the time involved? It will vary widely according to the kinds of trees, the soil and situation. I have presented some figures based upon the white pine. They indicate that it will be at least fifty to sixty years before timber of much value can be obtained. On better soil I believe this time would be considerably reduced. As a type of a more rapidly growing tree which is probably better adapted to our mountain land, particularly to the poorer parts of it, we may take the chestnut. Over a considerable part of the barrens before named the chestnut grows naturally, and occasionally one may find small tracts of young chestnut timber which is rapidly making a good record for itself. In all cases here at least this is sprout growth, and hence the trees are seldom as straight and symmetrical or as high as they would be if they had originated like the pines. The best of these trees are one foot in diameter near the base and are about twenty-five years old. The value of the chestnut for posts and the ease with which new trees spring up from the stump make it feasible to cut comparatively small trees to advantage. Upon some soils it is probable that black walnut will prove the best tree, and on the higher Allegheny plateau west of us the sugar maple and the beech seem well adapted; but of these particular trees I have only a general idea and cannot speak in detail. It has always seemed to me that the long time necessary to fully realize on an investment in forest planting would not be an insuperable objection whenever it is shown that the trees can be produced and that the need for and value of trees will be at least as great fifty years hence as now.

But since individuals seem so loth to undertake any such schemes on account of the expense and risks involved, why cannot corporations take hold of it? To this plan, which we owe to the botanist of this Board, Prof. Meehan, I wish to add the suggestion that gentlemen interested in hunting and fishing can, if they will, inaugurate forest culture to the great good also of their own organization for the preservation of game and fish. Let any one of the companies which buy or lease tracts of lands for sporting purposes not only preserve and protect the existing timber—which I believe they do because of its relation to the game—but also reseed and replant so large areas as their means will permit, and it will not be long before we shall have some fairly definite knowledge of the rate of growth of different kinds of trees, their value, &c., and some excellent examples which individual land owners may be willing to follow. A gamekeeper is of necessity something of a forester, and if game preserves should become a feature in our State it would seem feasible to have them serve as instructors in forest economy and their keepers to have under their special care the trees as well as the game and to arrest and have punished the poacher upon either. It may be that in this way we may have introduced into this country something of the spirit and method of forest economy as

it has been so long practiced in Europe but which in its entirety seems not adapted to our American conditions.

Still another suggestion. By way of familiarizing people with forest tree planting, as well as for reasons before mentioned, special effort should be made in roadside planting, not only on Arbor Day but on other days. When we see how much is added to our country roads where this practice is already common we wonder why it is not more popular elsewhere. In part the reason is found in that our system of allowing our highways to be the common foraging ground for domestic animals simply invites destruction of anything planted thereon unless extra and disproportionate expense is laid out in protecting the trees by boxes. In this respect, as in that of the forest fires, may we not hope that we shall soon see such a change in public sentiment that even the poor man's cow may lose the opportunity of worrying the life out of the prudent man's trees.

I am well aware that I have presented nothing really new on this subject to those who are familiar with it, but I trust that I may have presented some things in somewhat of a new light and attracted the attention of some who are or may be so situated that they can undertake some work of this kind. Pennsylvania, whose past prosperity has been so closely related to her forest products, ought not to fall behind in all reasonable efforts to sustain and revive an industry which seems to have nearly run its course and for which she has exceptionally good natural facilities.

#### TREE PLANTING FOR SHADE, SHELTER AND PROFIT.

By PROF. S. B. HEIGES.

[Taken from Annual Report of the Board.]

In the preparation of a paper upon the above-named topics, we feel that we will be obliged to consider much that cannot be called novel, or, in other words, we shall, in order to discuss the subject so as to be instructive and profitable, say and do what has been said and done, perhaps, a thousand times before.

There are certain conditions of nature that must be observed; certain physiological principles that must be respected; certain relations of species, soil, climate, and altitude that debar much originality of thought and deduction, for, from the period when "the Lord God took the man and put him into the garden of Eden, to dress it and to keep it" down to the present, men have engaged in, and inquired concerning tree planting.

History, ancient and modern, fully confirms, on many a page, the fact that many of the most noble characters that ever lived upon the earth, adorned and improved it by planting, and directing the growth of trees.

Trees have been admired—worshiped in many instances—by the various peoples of all times and climes. And yet how little of thought or forethought has been exhibited in many instances, not only in the selection of the kind of tree itself, but, also, in its location.

It is possible to make a home appear cheerful, inviting, hospitable, or dark, secluded, foreboding, by the location, number, and character of its trees. If they be not too closely planted, and are possessed of



open, spreading, extended branches, you are silently, but eloquently, invited to enter the home which they surround. On the contrary, trees closely planted, shutting out the view by their dense shade of compact limbs and foliage of a somber hue, tell the passer-by that this is a *private* residence, and that he only is admitted who presents his card.

Thus trees, by careful, studied selection and location, can impart to a residence a cheerful or sad, a scholarly or careless, a refined or debased taste. They, in fact, are an impress of the mind that trained them. Trees planted for *shade* may be utilized in many ways. We notice, in the first place, that they may be made a means of æsthetic culture, by developing an idea of the beautiful in nature, improved by art; that just conceptions of true outlines may be formed; that the beautiful and intimate relations of the parts to the whole, and the whole to the parts may be discovered; that the various types of stateliness, strength, gracefulness, stability—all the elements of form lie within the province of shade trees.

What better school for the student of nature can be imagined than a wisely arranged arboretum, and the trees of a home of airy pretensions may be an humble arboretum for its inhabitants.

Shade, undoubtedly, is an element of health, not that sunshine is not essential, but the deadly effects of the midday sun are evident from the many attacks of sun-stroke (*coup de soleil*), and the wearing of a few leaves within the hat or bonnet, as a prevention, can be copied upon an ample scale by surrounding our homes with suitable and sufficient shade trees.

Much of the unhealthfulness of cities during the hot months undoubtedly is attributable to their shadeless residences. The public squares have justly been styled "the lungs of cities." Discretion, however, should be exercised in the location of trees. No grounds are complete, as far as shade is concerned, that do not have evergreen and deciduous trees properly proportioned in number and variety. How frequently are the evergreens seen located closely to the buildings on the south side, whilst the deciduous trees are all placed upon the north side.

A moment's reflection should convince any one of the error of such a plan. During the dark and damp days of winter we want as much sunlight as possible upon the building. Now, this is obtained by reversing the order; placing the deciduous trees upon the south, that the leafless branches may allow the sunshine to even enter the building with its cheerful and healthful rays. We do not object to evergreen trees upon the northern view, if the grounds be sufficiently ample so that they may be placed at proper distance from the building. We emphasize: Health is of more importance than the most pleasing display of ornamental trees, even if the latter must be sacrificed to maintain the former.

There must be a selection of such varieties as will not grow out of proportion to the grounds upon which they are planted, *i. e.*, large grounds will appear more effective with massive, wide-spreading trees; smaller grounds with trees of less extended growth.

Dwarfed trees exclusively would be out of taste upon a lawn containing an acre or more, whilst the giant oaks, and elms, and maples would be illy suited to the unbuilt portions of an ordinary town lot.

A lover of trees would have no trouble in selecting from the follow-

ing list such as are possessed of all of the elements of form, size, hardiness, and longevity:

#### Deciduous.

Red maple (*Acre rubrum*), sugar maple (*A saccharinum*), Norway maple (*A plantanoides*), silver maple (*A dasycarpum*), black sugar maple (*A sac nigrum*), chestnut (*Castanea vesca*), horse chestnut (*Æsculus hippocastanum*), buckeye (*A gla bra*), tree of heaven (*Ailanthus glandulosus*), red oak (*Quercus rubra*), black oak (*Q. tinctora*), white oak (*Q. alba*), swamp chestnut (*Q. primus*), black walnut (*Juglans nigra*), English walnut (*J. regia*), locust (*Robinia pseudoacacia*), lindens (*Tilia Americana tilia Europæ*), beech (*Fagus ferruginea*), English beech (*F. sylvatica*), hickory, (*Carya alba*), pecan nut (*C. olivæ formis*), magnolia, acuminata, an umbrella, tulip poplar (*Tiriodendron tulipifera*).

#### Evergreens.

White pine (*Pinus strobus*), Rhotan pine (*P. excelsa*), red pine (*P. resinosa*), Corsican pine (*P. larico*), Austrian pine (*P. Austriaca*), Norway spruce (*Abies excelsa*), black spruce (*A. nigra*), white spruce (*A. alba*), hemlock spruce (*A. Canadensis*), balsam (*A. balsamæ*), European silver fir (*A. pectinata*), Crimean silver fir (*A. Nordmanniana*), Siberian silver fir (*A. pichia*), Lawsonis cypress (*Cupressus Lawsoniana*), American arbor vitæ (*Thuja occidentalis*), Chinese arbor vitæ (*T. orientalis*), European larch (*Larix Europæ*).

We have placed in a concise list trees well adapted for the three purposes contemplated in this paper.

Of deciduous trees for shade we would name Norway and sugar maples, English elms, tulip tree, horse chestnut, and Ohio buckeye, as being excellent varieties. Of these for rapid growth, hardiness, beautiful foliage, early and long continued shade, we place Norway maple at the head of the list.

For early and dense foilage, beautiful bloom and perfect outline of form, nothing is superior to the horse chestnut. As a street or avenue tree, it stands without a rival; in fact the pruning knife can very seldom improve its natural form. (Its slow growth is the only objection that can be offered against it.)

Of evergreens we know nothing better than Norway spruce, black spruce, American arbor vitæ, white spruce, balsam, and Lawson's cypress. This short list contains different shades of foliage, different degrees of compactness, erect and drooping habits of growth, and undoubted hardiness. The elm stands forth prominently as the most suitable tree for ornamentation of the college *campus*.

Whether it be the result of association—often the basis of taste—or whether of some property or quality possessed by the tree itself, we know not, but that they impart an intellectual, a classical air to the buildings which they surround, has been noticed by many a careful observer. They appear to best effect when the buildings present an ancient mien, and as institutions of learning should become more valuable as they assume the air of age, the law of harmony is more clearly defined by the presence of trees that only reach perfection with many, many years of growth. The lindens, too, are possessed of qualities fitting them for general use and pleasing effect along lengthy avenues, but their disgusting insect foes, so abundant of late years, will cause us to reject them from the list unless our entomological friends should soon provide us with an effective remedy for the protection of the for-



mer and the destruction of the latter. The oaks, "the noble old oaks," whilst scarcely suitable for lawns of humble pretensions, stands the peers of any in public squares, parks, and extended vistas.

But why impose upon the valuable time of this association? We have briefly developed the merits of sufficient varieties for lawns and ordinary-sized parks; the professional landscape gardener should invariably be consulted in every enterprise of more ambitious designs and enlarged area.

#### For Shelter.

Trees planted for shade become a means of shelter for man, but shelter, like many panaceas, is "good for man and beast." Provision should, therefore, be made for those animals which man has called around him, and which he has, by kindness and firmness, reduced to domestication. Our present system of farming, by which all our land is subjected to a system of rotation, necessitates the use of every field for pasturage in its regular order. Trees are almost as essential for shade and shelter as a sufficient supply of pure water. Those of us who have studied the habits of the *ruminata* observe their tendency to lie down during the process of digestion. How important that this process should be performed as nearly in accordance with the nature of the animal as possible.

Every field used as a pasture should have at least one wide-spreading tree of dense foliage under which the cattle can lie when they desire. I lately admired a noble oak standing in the center of a large field, the owner of which replied, "I have often been tempted to cut it down on account of the poor corn and poorer wheat raised under it." I pointed out to him its importance in the economy of nature, and he is now convinced that the shelter from the noonday sun to his cattle furnishes more of flesh, milk, and comfort than feeding the corn and wheat from an area equal this "shaded spot," and without the trouble of cultivation. Again, there are certain sections of country exposed to winds from certain quarters. How easily can we break the force of the same by properly locating trees so as to form barriers or "wind-breaks." These "breaks," by proper pruning on windward side, can be made to resist almost any tempest, and by trimming to a proper height on leeward side, can be made a shelter alike against heat and cold, rain and snow.

For the latter use we would advise evergreens, of long and pendulous branches. There is not the least doubt but that the force of the wind, and, as a result, the climate of a section can be perceptibly modified, even to such an extent as to materially benefit vegetable and animal life by concerted action in this direction. This, however, should be the labor of the State, rather than of the individual.

Evergreens, undoubtedly, radiate heat during the winter. By planting rows of medium-sized evergreens, at moderate distances, among our fruit trees, I have no doubt about rendering our crop of apples, pears, peaches, and plums doubly sure.

A few years ago, S. M. Purple, of Columbia, Pa., showed me a fine crop of peaches, the trees being in alternate rows with arbor vitæ, which had been planted in rows, midway between the peach tree rows, after the latter had been planted, for want of a more suitable place for the evergreens. I could not find peaches in any other location that season. I have since noticed the same result upon my grounds, upon trees planted upon the north, east, and west sides of a dense hedge.

Here, then, is a cheap and permanent means of protection for exposed situations.

#### For Profit.

So much of the benefit of trees for shade and shelter accrue to man's pleasure and health, that they should rightfully be set down upon the credit side of the profit account.

We presume, however, that *profit*, in the form of dollars and cents, was meant, when the question was submitted for our consideration.

We would suggest standard pear trees as being one of the most valuable of all varieties for profit. They make an excellent shade, are of rapid growth, come into fruit tolerably early, the fruit can always be disposed of in the natural state, canned or dried, or be converted into wholesome, delicious perry, superior to cider. The wood is valuable for fuel, and the trunk, with the stump carefully dug from the ground, makes the staunchest ship knees.

By the time pear trees now planted have reached mature growth, we may hope that this nation shall have acquired definite views of political economy, and if so, our now almost stagnated ship traffic, with newness of life, will demand all the timber of this kind that our country can produce.

The black walnut, which can easily be raised by planting the nut where the tree is to remain, or by transplanting when one year old, is valuable for its fruit, and also for its lumber, now so extensively used, finished in oil, in our best edifices and in our palace cars, cabinet organs, and expensive furniture.

Corn, potatoes, and other hoed crops, can profitably be raised amongst the growing trees, for quite a number of years. One must not forget that the stump, manufactured into "veneers," often commands a higher price than all the other parts of the tree.

The shag-bark is also a profitable tree as to fruit and timber, and is of easy growth, if treated as the walnut. The nut of the shag-bark can be made to yield large profits by sowing in swamps, otherwise useless, and cutting the young trees for hoop poles.

The chestnut, perhaps, is one of the most valuable timber trees, and is profitable, both for fruit and timber. In fact, a chestnut grove, whose trees are fit for fence posts, becomes as valuable for rails, in the course of twenty years, after the removal of the trees, if the numerous sprouts of each stump be protected until they can care for themselves. We cannot pass, unnoticed, the beautiful *grain* of the chestnut, which renders it so valuable as an in door timber. It is surpassed by none and equally by few.

The locust, in sections of our State, not infested by the locust borer (*clytus robinial*), is one of our most profitable timber trees. It also is not without merit as a shade tree. Its beautiful and fragrant bloom, followed by a dense foliage, renders it a tree not to be discarded by any means in an extensive collection. Its durability renders it very valuable for fencing and vine supports. One of Pennsylvania's veteran fruit growers lately informed me that, if he had planted his lands with locust trees forty years ago, he would have made twice as much as he has by fruit culture, and with much less labor and expense.

So long as our laws relating to highways are based upon the unjust principle of fencing wandering cattle out—not fencing farm stock in—so long will farmers pay their heaviest tax for a purpose not in the least beneficial. If it be possible, this association should devise some



means by which this valuable tree can be grown successfully throughout our entire State. It appears to flourish in all varieties of soil, dry and moist, equally well, upon mountain side and in valley. Among woods, it stands as the Concord among grapes; the friend alike of poor and rich. As a heat producing fuel we have found it superior to the maples and oaks, and but slightly inferior to the hickories.

The ailanthus, from its great tendency to *sucker*, is a wood of profitable culture. We have seen a dense grove formed in a few years, by planting a few trees upon a rocky knoll, which rapidly studded the ground with tall, erect, rapid growing trees. Its durability has not, to my knowledge, been thoroughly tested. It is a wood of high heat producing power. Its disagreeable odor when in bloom suggests the precaution of planting it at a safe distance from our dwellings.

We regret that time will not allow us to consider the claims of other trees valuable in many respects. We hope it will not be assumed that what we have omitted are useless or unworthy of consideration. All are worthy of trial in the list already reported.

It is to be regretted that with the frequent assessments made throughout the State, that no means were provided for estimating the percentage of timber land, the amount of marketable timber, and the amount of fuel per acre.

This association can vastly assist science by using its influence to obtain needful legislation in this direction.

If such data had been furnished from time to time, the vexed question of influence of trees upon rain-fall would have gone to rest with its fathers.

We have found the value of shade in preventing evaporation, by carrying out a system of repeated experiments (reported in *Gardener's Monthly*). Ground of equal tenacity, and alike in all other respects, loses about twice as much moisture *per diem* as equally wet ground *protected by shade*.

These experiments were conducted in such a manner as to necessarily leave undiscovered the influence of shade trees upon rain-fall.

Local writers inform us that certain streams in New England, sufficiently powerful to drive saw-mills, dried up as the timber was cut down for sawing.

Professor Orton, in Andes and Amazon, mentions a valley, in a mountainous district, which became less favorable for cultivation after the timber was removed.

The Suez canal whose banks now support, it is said, thousands of trees, is cited as a fit example of climate modified by trees. The water flowing through the canal, by our method of reasoning, rather fitted the climate for the trees than that the trees have modified the climate. It is not more likely that the soil of certain sections contains only sufficiently soluble material for one growth of trees, and that when these are removed there is nothing restored to the soil to induce a second growth.

Supply this deficiency, as the lesson has been taught us by the Mormons of Utah Territory, and the "desert place will blossom as the rose."

We are fully aware that the influence of forests upon rain-fall is a separate and distinct topic; but if there be any possible means of preventing these frequent destructive droughts, to which great sections of very fertile country are subjected, or any possible means of preventing too excessive falls of rain in others, by extending forest area

in the former and contracting it in the latter, it is a duty the State, yea, the nation, owes all sections, far more imperative than any legislation ever enacted, as tariffs for protection or tariffs for revenue. For we thereby arrive at one of the cheapest sources of profit, as all the natural forces labor for man without any recompense.

We wish to bid farewell to all loose generalization, and base our practice upon well authenticated, carefully observed, and scientifically collected facts; then, and only then, can we hope to convert this mass of empiricisms into the science of agriculture. Then, we predict, will man learn that God sends less rain upon the forest as he does upon the ocean, simply because less is needed there.

As far as data are available, it would be as logical to assume that telegraphic wires and iron and steel rails of our numerous railroads, extending over our country in every direction, affect rain-fall as much as destruction of forests does. Men have noticed, or imagined they have noticed, an appreciable decrease of rain-fall per annum within the last twenty-five years; they have noticed a wholesale destruction of timber in various sections. They couple these two circumstances as cause and effect, and talk learnedly of forest influence, and never stop to inquire concerning the annual rain-fall, much less to keep a rain-gauge, which would convince them of the folly of many of their conclusions.

We know that meteorological changes are largely dependent upon electricity. We have frequently found both iron and steel rails, more frequently steel-capped rails, highly charged by an inductive current. In one instance, we found a telegraphic wire, unconnected at either end by a battery, highly charged with electricity; messages have frequently been sent several miles using the earth instead of the line wire.

Hear the following meteorological result, as fairly established as any forest influence upon climate:

The natives say that since the *terre mote* of 1859, the seasons have not commenced so regularly, nor are they so well defined; there are more rainy days in summer than before. [Orton's Andes and Amazon.]

Here are cases that bear as strongly upon the question of rain-fall as forests, yet electricians do not claim them as available forces, because they lack scientific confirmation. It is to be regretted that men who observe least closely are always most easily reconciled to their theories, and most aggressive in advancing them.

I wish it clearly understood that I do not deny to forests the exerting of climatic influence, but I do firmly believe that the fact has not been established by fair, honest, scientific investigation and data. Let us, as a body, carefully move toward the truth, trying all things, holding fast to that which proves good, above all things be loth to announce the result of *guesses*, to as carefully weigh our words as we would the results of the most accurately conducted experiments; then and then only will men place confidence in our deliberations. Then shall our light be of such a nature to the agricultural world that it cannot be hidden under a bushel; yea, it will shine from the top of a hill, even the Capitol hill.



## HOW CAN A STATE BEST PROMOTE THE INTERESTS OF FORESTRY?

By FRANKLIN B. HOUGH, Lowville, N. Y.

[Taken from Annual Report of the Board.]

The repeated and earnest recommendations of His Excellency the Governor of Pennsylvania, in behalf of measures tending to economize the existing timber resources of the State, and to provide against future wants in matters relating to forests and forest products, cannot fail of meeting with the cordial approval of every thoughtful citizen, and naturally leads us directly to the question which we have placed at the head of this article.

Passing over, for the present, all questions relating to influence upon climate, water supply, agricultural production, and other matters incidentally connected, we will, for the present, limit ourselves to the single point of wood as a material for use in the various arts and industries in which it is employed, and for domestic consumption, and seek for ways by which its production may be aided or promoted by a State government.

With respect to Pennsylvania, we notice from the last reports of the Land Office that about two million three hundred and forty thousand acres, or about one-thirteenth part of the area of the State, is at present unpatented. We have no information as to how much of this may be in course of transfer, nor as to its location, amount of timber growing upon it, or its fitness for the growth of forests. There can be no doubt but that timber lands belonging to a State, or to the General Government, might be managed with the view of maintaining them for the growth of wood.

In the British provinces on our northern frontier, a system of leasing timber rights is in operation, in which those acquiring the privilege are allowed a certain time for removing the timber, the title still remaining in the Government. It does not, however, include any particular system of reproduction; but this is implied in cases where a tract of timber land is cut over and allowed to remain undisturbed by fires or pasturage or other injuries for a sufficient length of time.

We are not prepared to recommend the application of this principle in Pennsylvania in the absence of information concerning the condition and circumstances of the lands owned by the State; but we earnestly commend the thought to the careful study of those who may be in a position to know these facts. It would be easy for such to obtain from the Commissioners of Crown Lands of Ontario, Quebec, and Nova Scotia, and from the Surveyor General of New Brunswick, the several laws that are in force in these provinces, and all the details relating to their operation; and from the office of the Minister of Agriculture and Statistics at Ottawa, the corresponding information concerning the public lands in charge of the Dominion Government in the north-western Territories and in Manitoba.

These laws are singularly defective in some points, that will suggest themselves upon a careful study, and should be modified, if adopted by any of our States, or by the General Government, as the basis of a plan for the management of timber lands. Under certain circumstances, the plan is a good one; but it will require faithful agents to secure its profitable operation.

But many of our States own no public lands, nor can they manage forests on State account, as is done in most of the Governments in Europe, without first acquiring lands by purchase. We are, moreover, quite wanting in preparation for such a work, having no agents specially educated for such a service, and none of the experience needed for successful administration. We cannot forecast the future, but from all that is now known, the time is distant when we shall see in successful operation a system of forest culture under State direction, as we see in Germany and France; and for the present, we must mainly depend upon the results of planting by the owners of the land, and must labor diligently to inspire in every owner of an acre the importance of caring for whatever timber they now have, observing strict economy in its use, guarding against every chance of loss or waste, and planting wherever it can be done with chance of success, as a provision against future wants.

Although every farmer has the means upon his own land for raising all the wood he may need for fuel or farm uses, without sensibly reducing the yield of his crops (and often, while increasing them, if proper discrimination is observed in planting timber, where its shelter is needed against drying winds.) We can hardly expect that farmers, as a rule, will ever come to supply the markets of the world with timber and lumber as they do with daily products and grain. The wants of timber for commerce are vast and increasing, the demand for building purposes and construction of various kinds is immense, and will never be less, and the needs of wood in various ways in the arts are too obvious and too numerous to mention.

From whence must these supplies come? When we consider the length of time that must elapse in forest culture, between seed time and harvest, we are reminded that a human life is scarcely sufficient to measure these periods; and in seeking for an agency of direction, we feel the need of one comparable in duration, with the pines and oaks that we seek to create and perpetuate. In other countries owning large landed domains and organized differently from ours, we find these elements of durability and uniformity in the Government. Our systems of government are, in theory, quite as durable as theirs, and patriotism might justify us in believing that, in a general way, they are better suited to our wants; but in matters of timber culture, we must admit, that we are not prepared to manage forests on State account, by direct control, and must seek for other agencies, having the required features of permanence and ability, and are naturally led to regard corporations, as presenting these qualities in ample degree. The business requires capital that can afford to wait long periods, if sure of earning large profits; it needs skilled agents, who are qualified in all that science can impart, and sagacious counsels that can meet the financial questions that arise, and direct affairs for the best interests of the organization. All of these may be secured by corporate bodies in fullest degree; and we cannot doubt but that, as the want comes to be felt, we shall see them arising, perhaps, on a scale comparable in magnitude with those that control the railroads of the country, that will undertake to supply these great demands, and control the prices of timber products in the markets of the world. Rightly managed, it is a business promising a large and certain return upon the investment, and one that is free from many of the losses resulting from suspension of business, depression in market prices, and many other casualties in business that so often occur.



Whenever a great manufacturing establishment is obliged to suspend work from a stringency in the markets, every thing tends to ruin and decay. If it be one filled with delicate machinery, it will rust; if one in which much dampness has been maintained, it will rot. In short, we can think of none that would not require expense for maintenance and repairs, or that would not return to business in poorer condition from long idleness. In none would they be better, and in many, worse off than in a new beginning, because better machinery or improved methods might be introduced with the benefits of latest experience.

But in forest culture the property is always gaining in value, and if obliged to wait at any time for an improvement in prices, it will come upon the market with enhanced value. Such an investment would have none of the uncertainty attending vein mining for the metals, and would not be in the remotest degree dependent upon changes of fashion as in many manufactures. It would hold out no prospects of vast and sudden wealth, as in some mining speculations, and at the same time it would guarantee the investment against probable loss. In fact, the whole future of the enterprise would be known from the beginning, and its product at a given period of the future, might be known beforehand as to quantities with reasonable certainty. Such an investment having few of the uncertainties that give importance to many speculations, would be very slightly affected by fluctuations in the prices of its stock. After a few years, the returns would be regular and increasing, its dividends would, under faithful and competent management, be regular, and its investments safe. By using broken land not susceptible of agricultural improvement, the first investment would be small, in comparison with the value, when once established, and while the owners of capital thus invested were receiving a fair and certain return for its use, the whole country around would be benefited incidentally by the modifying influences of forest growth.

Returning from this digression, and admitting again that the plan proposed is not yet ready for realization, for the reason that it is a new project which capitalists will first approach with caution, we come directly to the question first proposed: "How can a State best promote the interests of forestry?" If the State at present cannot, and if associated capitalists will not, until first carefully studied and fully tested, we cannot do more or better than to encourage planting by the owners of land. If this custom can be brought about, and if it becomes general and is conducted with intelligence, we shall, in a few years, be better supplied with woodlands than we are to-day. They will be distributed through the country where they are needed for use, and private interest will provide for local wants, as the inducement is offered, and the certainty of profit is foreseen. We will, therefore, suggest the following, as among the most easy and certain ways in which a State government can promote the interests of forestry:

1. By offering premiums for the planting of trees; and this can best be done through the agency of agricultural or horticultural societies. A given sum will doubtless secure a larger result, if it be offered in many small, rather than in a few large premiums. Let these be classified according to the kinds of timber planted, having reference to soil, sub-soil, and other circumstances that may affect tree growth. The *highest importance* should be attached to *greatest area* or *greatest number*. In some of the western States, an arbor day has been des-

ignated, which is well, so far as it brings a good result, but above all we should avoid the error of *limiting the premiums to the plantings of a given day*. They should always be for *the season*. The appointed day may be stormy; it may not suit one man's convenience; it may be less favorable than many others, and it may restrict to a single day the labors that should extend through many. Of course the success of the plantation should be first assured, and, therefore, there must be delays in the payment of premiums, perhaps two or three years, and the methods employed should be reported, and those particularly successful should be published. By having one premium for *greatest variety*, we might occasionally strike a *success*, beyond what could be realized from the cultivation of the native trees of the locality, or what is quite as important, a *failure*, that would hinder others from going blindly into an adventure that would end in nothing but disappointment. In all reports, these failures should be mentioned, quite as distinctly as the bright side. Let us know the percentages of each, and enough concerning them to judge how far the one can be imitated or surpassed, and the other avoided.

It would be also well to arrange the premiums, so as to particularly interest the young in the planting and care of trees. An early impression may be long remembered, and a love for this employment thus impressed may last a life time, and be imparted to generations beyond. These premiums might also have reference to displays of forest culture at public fairs, and to best essays on management. If ladies can be interested in these competitive enterprises, as applied to home adornment, and ornamental planting, a decided benefit will be secured. An appreciation of the beautiful on the lawn, is transferred easily to the grove and the woodland, and we are led to admire beauty in a tree, or in the grouping of trees, wherever found.

2. The State may encourage forest planting by exempting from taxation, for a specified time, such cleared lands as may be planted in forest, or if, as in some States, the Constitution forbids the exemption of property from taxation, it may declare that *no extra valuation shall be added by reason of forest planting*. It may also encourage planting along highways by allowing deductions to be made from highway taxes or by direct allowance of money, according to number of trees or length of rows thus planted, assurances of success being first had.

3. It is well worth considering whether the State may not properly impose a *tree tax*, analogous to its road taxes, to be satisfied by the planting of trees, or by the payment of money that shall secure their planting. This, if done, might be justified under that right of eminent domain by which the government may require a thing to be done where the public welfare demands it. Illustrations of this appear in the recent legislation in Europe, by which the owners of "dangerous lands" may be compelled to plant or may be forbidden from clearing them. In this class would be found such timber lands as shelter a town from prevailing storms, or that would be liable to erosion by torrents, if cleared, or that intercept the malaria from a marsh. It also includes lands that should be planted for the public good, such as drifting sands, wind-breaks to prevent drifting snows, and tracts that should be kept in woodland for the maintenance of springs, etc. Of course, in all these cases the owner's rights must be regarded, and those who are benefited should pay the cost, whether it be village, a city, a county, or the State.

4. There can be little doubt but that a heavy drain upon our forests



is due to *needless fences*. If cattle were kept *in* and not *out*, if the highways can be defined by lines of trees instead of fences, a great saving (equivalent to so much gain) will be secured. This can be accomplished by a modification of the fence law, where necessary, requiring the owners of domestic animals to keep them upon their own premises, division fences between pastures being kept up jointly by the owners, but otherwise in severalty by those who pasture to a neighbor's line. We are aware that this doctrine of few fences will be regarded with little favor by the thrifty farmers, who have prided themselves upon the excellence of their boundary and partition walls of wood; but consider their cost.

5. Forest fires, in some years, destroy more timber than all the wants of our population and all the demands of commerce require. The most stringent laws should be passed and enforced against the careless use of fire in or near a woodland. It should have reference to the burning of fallow land or of brush, charcoal burning, the careless use of matches, or negligence in building fires for any occasion where the least danger is to be apprehended. Additional precautions might be required of railroad companies with regard to fires.

6. It is admitted by all who have given due attention to the subject, that the birds are our best friends, in destroying the insects that injure our field crops, our orchards and gardens, and our forest trees. It is known to all that birds multiply in proportion to their protection, and to their opportunity for nesting in woodland hedges and groves. This is a subject of vital interest to the farmer, and his interests demand stringent game laws, thoroughly enforced, and a spirit of kindness towards the birds, that shall encourage their maintenance up to the measure of their need. It is true, that birds are not insectivorous. It is also true, that all insects are not injurious, some being in effect our best friend; but the balance of nature, when undisturbed, hangs level, as regards these great classes of animal life, and a game law protecting all birds at all seasons would be much more effectual than one that leaves the opportunity for destruction open a part of the year. So important has the injury from insects due to the destruction of birds become in Europe, that active measures have been taken to restore the injury by preventing the cause. The utility of birds, and a sentiment of kindness towards them, is taught in schools, and little societies for protection are formed among the scholars, under the advice and encouragement of the teachers. With a plenty of groves and belts of woodland, there would be an abundance of these useful allies of the farm.

7. There are cases in every State where drifting sands in summer and drifting snows in winter produce great injury, the former often burying fertile lands, and the latter obstructing travel in winter. The State owes it as a duty to its citizens to provide by law that the local authorities, at local expense, shall remedy these evils, which can both be readily cured by planting trees. In cases where a particular part of the highway is habitually obstructed by snow, the officers in charge should be empowered to take in the same manner as land is taken for new roads, a belt of land, sufficiently wide for planting a screen of evergreens on the windward side, and should be empowered to plant and maintain the same in the same manner as roads and bridges. In cases where existing woodlands protect sands from drifting, the owner should be forbidden from cutting them down. But as such prohibitions might lessen the value of his property for the public good, means should

be provided for ascertaining and protecting these rights. In the recent German law forbidding trees from being cut where their removal would allow torrents to erode, the parties endangered in the valleys below, are required to pay in proportion to their interest, for the extra expense or loss that the owner of the wood suffers from its remaining.

8. The State can aid colleges and other incorporated institutions of learning in establishing a department of instruction in forestry, or at least assist them in providing some instruction by way of lectures, cabinets, and other appliances of education in the interest of tree culture and forest economies. It can *require* such instruction and other means of learning at all institutions receiving support from the State, especially in normal schools, from whence useful ideas might be carried to the primary schools, by those prepared for teaching at public cost. Every college and seminary should have a living collection of the native and the principle foreign trees adapted to the locality, properly labeled with common and botanical names, and students should be taught at least their names, uses and distinguishing traits. One large premium for the best arboretum, might lead to the planting of a dozen. Collections of wood specimens, properly prepared, would be very instructive in seminaries of learning of every degree, and if classes could be encouraged in forming these, the information gained and interest awakened would prove very useful for life. As we sometimes value objects that have cost an effort, more than a free gift, all subsidies in aid of these objects should be conditioned to the raising of an equal or larger amount by those receiving, except where the institution is wholly owned and maintained by the State.

9. The State can direct experimental stations to be established, for showing best methods, or testing new species, or conducting special researches. These can best be done at State farms, and at colleges, in connection with the course of instruction, applied sciences, natural science, etc., and in the latter, partial aid may perhaps secure full results, the balance being paid by the institute. Meteorological observations with the view of studying the effect of woodlands upon climate, methods of planting and management, the effect of fertilizers, differences of result on peculiar soils, etc., might come within the range of these observations. Of course where such a station was an object of interest to visitors, care should be taken that the casual observer shall not mistake an experiment, intended as a trial and leading to a result unknown, for the best result of the best method. If there is risk of this, the trial experiment should be closed against the general public, and only such should be open to every one, as all might imitate in their own cultivation with profit.

10. The State can cause its forest resources to be explored, and its wants and capabilities to be made known, and it can cause useful information to be published upon these subjects.

11. Additional means should be provided for ascertaining the statistics of production and transportation of forest products, so that the real condition of all interests depending upon these industries can be better known.

12. The State could enlarge the powers of city, borough, town, and village governments, in providing parks and rural ornament in their streets or suburbs, whereby a refining influence would be created and diffused, tending to the improvement and enjoyment of its citizens. In questions involving expenses beyond a certain amount, an expres-



sion should be allowed by a popular vote of those most interested in a given street or district on which the cost would fall.

### FOREST AND RAIN FALL.

By THOMAS MEEHAN, *Botanist of the Board.*

[Taken from Annual Report of the Board.]

There is a maxim, very good for myself, as well as gentlemen of your pursuit, good agriculturists, that a man does not know what he can do until he tries. Speaking of good agriculturists, reminds me that when it was announced that I should address you to-day on rain-fall and forests, some of my friends expressed surprise that I should talk on such an "abstract question" as this. How can it matter to a farmer of to-day, if the forests are cut away, if he can sow and reap, and if he can gather the products of the soil? In the language of a certain distinguished individual, we might say, "What has posterity done for me?" Why should I care for posterity? For my part I cannot assent to that view. I think every great, every patriotic person, has some consideration for his posterity. I think that many questions considered abstract and abstruse are not really so. More of these questions have a practical bearing on the present than we suppose. They are not of so little moment as many would make them. We have suffered very much, in fact, through our indisposition to discuss little questions. Others have benefited us by taking them up. For instance, we can now cross the Atlantic in ten or twelve days, when it took Cabot one hundred days. Once it took a long time to send messages from Washington to New York; now they are transmitted in a few seconds. Chiefly through Franklin's playing with the kite, string and key, we accomplished this wonder. Through the experiment with the tea kettle we have the locomotive. It was through these little matters we have got these practical workings. In regard to this question of forestry and rainfall, you know what it is. It has been told in every paper and magazine. There is the Desert of Sahara, embracing four million square miles, where rain never falls. In our desert of America, extending along from Texas to British North America, rain does not fall. They say that is the clearing away of forest, and that we are now suffering from the devastation and destruction of forests by some ancient people. I think we can show that that desert was brought about not by the cutting away of trees. We think that that is the result of sudden geological causes, and that those sudden geological causes are continuous, and that they have no reference to forestry in any shape or form. Before, however, going into that question, it would be as well to take up frankly, or come down to little things, and first explain what causes currents of water in the atmosphere—condensation of moisture before rainfall, and although it may seem almost a common-place matter to refer to such little things, yet I think it will enable us to explain our position better by referring to them. Take a pitcher of cold water on a warm day; moisture gathers on the outside of the pitcher, and we commonly say that the pitcher sweats, but it does not. It is simply the moisture in the atmosphere, which, being warmer than the outside of the pitcher, causes the water to condense. The same process is going on over the sur-

face of the globe. Three-fourths of the globe is water, and the average evaporation is about twelve thousand pounds per square foot per annum. Of course, in some places it is less, and in some more. What becomes of this water? It is taken into the atmosphere, and, when brought into a cooler current, it condenses and falls. In regard to the circulation that causes the currents, take a bucket of water, and put a stick into it. The stick floats, not because of the gravitation, but because the water is heavier than the stick. The same principle prevails if you take a kettle of boiling water.

The upper surface is the hotter, and that forms a continuous circulation, because the cooler presses the warmer to the surface. In that way there is a continuous circuit exhibited by the changes in the specific gravity of the particles. That is going on also in the atmosphere just the same as in the kettle of water, that which is warmest raises to the top. So with the Gulf stream. The warm water of the tropics forces it upward. Thus there is a continuous circuit toward the poles, where it is cooler. Now we can begin to understand how it is that we get rain in some parts of the world and it is dry in others. In sea breezes there is a current of water all the time to the land. The water which is changed into cold vapor, of which I have spoken before, rushes in to take the place of other water in that way. The warm water that makes the vapor is all upon the surface of the earth, is carried along until it comes in contact with cooler surface, and produces rain. Now, as to the American desert, which extends eastwardly from the Rocky Mountains: The water is drawn up from the Pacific Ocean; the cold or moist air of the Pacific is brought in over these mountains from that direction. It gives the prevailing easterly winds on that side of the mountains. This vapor is carried along until it reaches the top of the mountains. When it comes in contact with these high ridges it is condensed and becomes snow. When there is any moisture in the current it consequently becomes rain; but here it leaves only a dry current to pass over it. It is only two or three hundred miles this side that it becomes moisture. From this moisture which forms in that way we get another condition, or area, which is continually watered by rain from the clouds. You see, therefore, that this snow or rainfall this side of the Rocky Mountains, or more properly this side of the Mississippi river, could not have been caused if the Rocky Mountains were not where they are, and it would be a matter of total indifference whether forests were cut away or not. It is a question wholly of currents with these different parts. This tract of land, which is now a desert, was once covered with forest trees. If you dig down in Illinois or Indiana, you find large beds of coal. Further on, in Colorado and surrounding country, which is now a desert, I have helped to dig out what is called charcoal. I have dug up trees. Some of these stumps, one of them especially, was twenty-four feet in circumference, and others in proportion. These forest trees existed at one time where now the country is a barren desert. It shows that the whole district was once covered with trees, and that they were not cut away. These trees were grown up when the whole range of Rocky Mountains was thrown up in this way. That this was done is shown not only by remains of trees, but by large beds of fossil fish, which exist some five or six thousand feet above the level of the sea, showing that these parts were thrown up from the level of the sea. Then there was no sifting out of the vapor of the clouds, but the moisture fell there in rain, just as it falls over other surfaces of the globe;



and the throwing up of the hills afterwards makes this difference. Some parts of the world have these sinking parts and others arise.

In regard to climate, no matter how small may be a cause, it interrupts the regular work of events, and a very small disturbance in these conditions will cause a great change in results. Thus a little rock will fall, and it gradually turns out of its course in consequence a small stream; and having turned it out of its course, in time something else changes, and the whole course is changed by a very little circumstance. And so in nature; and that is the reason we think sometimes there are great changes in the climate. Take, for instance, the Polar expedition, and its discovery of an open sea in 1863. In 1875, when Captain Murray's expedition went there, they found this whole tract covered with ice; the thermometer being from 55° to 65° in 1865; then he found it the whole season below the freezing point. It is only the condition of things that come; altering in a few years, and the circle continues to go and come. I think the best illustration, perhaps, is the history of the grape culture in England, which bears on the change of the climate. We know that England at the present time is considered totally unfit for grape culture; that grapes cannot be raised under any circumstance, and yet we know there was a time when it was covered with grapes. The battle of Hastings, which decided the fate of English people, was fought in a vineyard, and we read of vineyards, the isle of Ely, which signifies "the isle of vines." We have traces of ancient vineyards in every direction. These vineyards continued down to 1685. From that year there were twenty-five years of regular wet and cold seasons, in which it was impossible to ripen the grape; and so until the present day. Now, it seems almost a fable that England ever was a grape-producing country; and yet timber was not much cut away. There was, no doubt, good timber until manufactories became common; and they did not become common until the mining of coal. So there could have been no change in twenty-five years, by cutting away forests from lands wholly fit for the grape to land totally unfit for it. Here comes the most significant part of the history. At the present time, one gentleman in grape culture there, the Marquis of Bute, in Gloucestershire, some years ago planted vineyards, and his grapes are doing just as well now as they did in ancient times. I think this fact shows fully that they did not result in any way from tree culture or forestry. In our own case, we know how the climate changes. I am satisfied that thirty years ago in Philadelphia there never was a year, before or after that, that the lilac did not bloom regularly before the first of May. For the last year or two the same bushes around our dwellings are flowered well before the first of May. There has been no difference in the forests of Pennsylvania. I think there is the same amount of forests in Pennsylvania to-day that there was before that time. Before railroads and canals were made, there was a great deal more lumber taken to Philadelphia from Pennsylvania than there is now. Timber lands have been suffered to grow up again. I know of property near Philadelphia, where persons desired to leave to their descendants those forests, and now those forests are worth nothing, because timber can be brought from a distance cheaper than it can be bought there. I think Pennsylvania has more woodland than thirty years ago; and there are figures which go to show this. In England there is only about five per cent. of the land covered with forests, and this is probably as much as it has had at once; because England's past forest area was so small that the king set to planting

forests for ship building timber; so I think that area has been as it has for many years past, and yet the average rainfall is forty inches a year. There is Portugal, which is almost destitute of timber, having only 4.40 per cent., and yet the rainfall is thirty inches a year. And in Spain, with 5.53 acres to the hundred, there is twenty-five inches a year. Sardinia, with twelve per cent. of its land in forest, has a rainfall of thirty inches. In Switzerland, the forest area is only fifteen per cent.; while in Norway, it is sixty-six per cent., which has a rainfall of only thirty inches. On the other hand, is Sweden with sixty per cent. in forest, and only sixteen inches of rain a year, and Italy, with comparatively few forests, has forty inches of rainfall a year. So you see there is not the slightest correspondence. I think it is impossible to give the cause which influences the fall of rain. In our own State there is forest now, and we cannot make much of a test yet. But there has been no diminution in States where the forests have been cut away, for instance in Ohio, which was, we know, a vast timber region when it was first made a State. It has been considerably cleared of its timber, and yet the records kept by the government officers in Marietta show that there has not been the slightest difference in the rainfall of Ohio. So in some other States the rainfall has not been disturbed. In the New England States considerable attention has been paid to it, but we have been unable to get the figures. Massachusetts, for instance, at the present time has twenty-seven per cent. of its area in forests; Vermont has twenty-six; New Hampshire has twenty-seven; New York, twenty-two; and it is believed that twenty-five per cent. of the whole area of the United States is forest land. The Southern country is half forest. West Virginia alone has one million of acres of forest land. I think when it is shown full how much there is even in the Western country, you will see that the whole timber average of the United States is forty per cent. The figures are high, and yet in some of the Southern States they feel that there has been some climatic change; and the timber area continuing the same, the result is that these changes are not due to the absence of forestry, but to geological effects. When you consider the causes which influence rain, and when you compare them with countries where rain falls abundantly, and where it falls sparingly; and when you compare these with the facts as they have been given, you will agree with me that there is no difference in the rainfall, and that the facts show there is not.

Mr. CALDER. I have an intimate acquaintance with Mr. Meehan, and I know he will be very much disappointed if we do not pitch in. He expects us now to pick his address to pieces before he goes away. I hope that as we are hearing continually with reference to the destruction of our forests as influencing our rainfall—that we are about reducing our country to a desert by the wilful destruction of forests—if friend Meehan is in error, let us seek to convert him, and if some of us have been in error, let us now and here make confession.

The SECRETARY. I would indorse all that Doctor Calder has said. Mr. Meehan has requested me to state that he will be glad to answer any questions; that if he has any information which can be of use, he will be glad to be of service—hence I hope you will feel free to ask him any questions which may occur to you.

D. H. FORESMAN. I will ask the gentleman a question—whether the cutting away of three hundred million feet of pine timber from the western part of the State would affect the eastern part? There is that



much cut in the western part of the State every year. If it did affect the rainfall, would it affect Philadelphia?

Mr. MEEHAN. It would certainly have an effect, as an abstract principle. It might affect Philadelphia—because if the forests were denuded to the extent that the gentleman says—the land exposed to the action of the sun—and the sun of course drawing (as we say) heat to the earth, causing the ascension of a warm current—that warm current drawing in that way, would cause other currents to flow into it. The variation of the current may make a variation in some particular locality. This might be, and as currents which cause rain are usually very high up, and not below, it is not likely to affect, but, as an abstract principle, it may make some difference.

D. WILSON of Juniata. I did not understand your explanation of the cause of the American desert on the east side of the Rocky Mountains. I understood it in part. Why is it that that American desert continues to be a desert? and why does it continue to be a desert so far northward?

Mr. MEEHAN. I thought I explained that, but probably did not clearly. I have watched the clouds coming over those mountains, and they climb over like flocks of sheep. They go over, and then disappear; you cannot see where they go. They go into snow. The current goes on eastward, but no moisture, consequently no rain falls. The current has not time to gather moisture at all, until it goes further on. So it is absolutely impossible that rain should fall there. It has been sifted out from the tops of these mountains.

D. WILSON. In the neighborhood of the Missouri and its tributaries, there is forest, is there not?

Mr. MEEHAN. There is timber all along all rivers; and I am glad that you have mentioned that, because it explains a matter I referred to, but I am afraid of taking up too much of your time. There is a statement in English papers which reads as follows: "The Suez canal has produced remarkable results. Ismailia is built on what was a sandy desert, but since the ground has become saturated with canal water, trees, bushes, and other plants have sprung up as if by magic, and with the re-appearance of the vegetation, the climate was changed. Four or five years ago rain was unknown in those regions, while from May, 1868, to May, 1869, fourteen days of rain were recorded, and once such a rain storm that the natives looked upon it as a supernatural event."

There, you see, a large body of water is taken across the desert, and makes the trees grow. The trees could have no influence on the rain; but the moisture, when it is brought into the canal, soaks through the ground, extending probably for miles. The water that springs out at our feet does not come up from there, but from miles away, and may be from the snows of far distant mountains. Almost all our springs come from lakes in that way. Underground rivers continually flow toward the sea, as well as those above ground. Lake Champlain is largely above the level of the sea. Salt Lake is four or five thousand feet above the level of the sea. These lakes continually leak, and the moisture flows in numberless directions under the ground; sometimes flowing for hundreds of miles before coming to the surface. So with the Suez canal; and rain, in some manner, would fall there, for the water brings the current with it. There is a moist current drawn from the canal from every direction. As these currents meet—the

warm and the cold—there is no reason why rain might not fall for forty or sixty miles in every direction.

Now, the same principle prevails along those rivers which you referred to; that is, it seems that trees always line the rivers. You can trace these rivers for miles and miles by the trees that line their banks. There may be more rain in the vicinity of the lines, but not because the trees are there.

Prof. J. P. WICKERSHAM. I am inclined to think that the views of the gentleman are correct, in relation to forests, and the extent of the rainfall; but, I hear our farmers complaining of the increasing dryness of the ground, and the smallness of the streams. Old farmers tell us that the ground does not maintain the moisture it used to do, and the streams are smaller. This may arise from two causes: When forests are cut away, much more land is exposed, and it may be from the increased rapidity of evaporation. After these forests are cut away, it seems to me likely that the rain that falls upon the ground, would be more rapidly evaporated; and thus with the streams running through surrounding lands. These streams may be larger when the rain falls, and the water will run off more rapidly. Now, if forests retain the moisture longer, and spread the moisture around, it may be that the destruction of the forests has produced all the effects that the farmers have complained of, although the amount of rainfall may not be decreased.

Mr. MEEHAN. The fact, sir, is as the gentleman says. There are many streams which, at one time, ran large quantities of water, and which are now dry. But that has no connection with the forestry question. The same laws prevail under ground as on the surface. In their flow under ground streams are continually meeting with obstructions. After wearing through hard rock, they may come into softer rock, and, like human beings, prefer the easier road. Wells give less water, because streams under ground have turned in some other direction. Take the Mammoth Cave. Every once in a while the water got a softer place to run in than it had before, until it ran out, and left a great highway. That is the reason some streams become dry, but the effect could not have any relation to the trees, because vegetables want water. Three-fourths of the rainfall is actually consumed by the vegetation. Not one-fourth of the water that falls finds its way into the streams. It may be much less in a patch of watermelons. The waste wood that you find is three-fourths water. Look, therefore, at the immense amounts of water that are consumed. Cut away the trees, and there ought to be more water for the streams. You see how contradictory it is. It seems, therefore, that the cutting away of trees could not lower the streams, and it is not only impossible and without reason, but however explained and reasoned otherwise, it is on account of the constant change of the underground streams.

Prof. J. P. WICKERSHAM. Do I understand that the gentleman holds that evaporation is not greater where the trees are cut off than where there are trees growing? Of course, certain portions evaporate. Now, then, I want to know from the gentleman whether he takes the position that evaporation in a forest is not less upon the same land than if the forest were cut away?

Mr. MEEHAN. The evaporation is greater from forest land, than where it is cut away, because the roots of these trees extend down ten or twelve feet below the surface, and they are as little pumps. The



amount of evaporation from the leaves of the trees is enormous. Consequently, your evaporation power is extending twenty-five or thirty feet in depth. When it is cut away the sun does not descend so deeply. With trees, you have six or seven feet, or more, pumped; so, necessarily, there must be more water escaping by evaporation from forest ground, than where there is no forest.

D. WILSON of Juniata. I think the gentleman's argument is contradicted by the facts. Where forests are there are often swamps. After cutting away the forest, grass will grow, and the water becomes dry land. I cannot see the effect that Mr. Meehan does. It does seem to me that the rays of the sun have a far greater effect than the roots and the leaves of the trees. Moreover, if the theory of the gentleman is true, if you let the waters of the ocean into the Sahara Desert, every part of that will "blossom as the rose."

Mr. MEEHAN. I think the gentleman is right and wrong, too. The surface water, of course, dries up. The wind and sun would dry up the surface water much more rapidly than the trees do. But you will find that there is more evaporation in land with trees than that without. Place a thermometer in a forest, keeping it clear of the evaporation, and the thermometer will go to 110 or 115. Take other land, and you will find 75 or 80. There is a difference of twenty degrees between the temperature of the land covered with grass, and where there is no grass. More moisture will evaporate in 100 than in 75. There is less evaporation in land covered by grass than in land covered by nothing.

Prof. J. P. WICKERSHAM. Suppose we take out a cubic foot of land from a forest, take it on the surface, and ascertain the moisture in it, does the gentleman maintain that there is less moisture in that than if we were to cut it out of a bare mountain, of the same kind of land?

Mr. MEEHAN. I not only know that, but know it from actual experience in both winter and summer.

M. C. BEEBE. Take up any elevation of land, elevated, of course, where there are forests, and where there are large springs flowing out. Cut away those forests, and just as you progress, even to a small extent, those springs will dry up. Will the gentleman give us his view of the cause of that? This certainly is the experience.

Mr. MEEHAN. It probably dried up where the source of the spring is hundreds of miles away. I have a spring on my property, discovered by the Indians. I know there is as much water there as ever.

M. C. BEEBE. Take central New York, where the hills and valleys of that country were just a morass, impenetrable to the early settlers, and it has gradually gone away. From these hills emanated streams that carried saw-mills and grist-mills. Just as the country has progressed and improved those streams have ceased to run. This in such numbers that no one can doubt, it seems to me. The valleys themselves have become excellent meadow lands, and fit for cultivation. Why did they?

Mr. MEEHAN. Of course we should have to be there. It is easy to ask the question, but to answer will require examination into geological details. We know that even in regard to lakes, there is a rising and a falling, owing to their geological conditions. We have an illustration of that in the Salt Lake. Twenty-two or twenty-three years ago it was much lower than now; but since then, and the cutting away of the forests, the lake is gradually rising. It is probable, on an average, six feet higher than when the Mormons first settled there.

When they first settled there, the valleys and streams abounded with cotton-wood trees and others; but they have cut away, so that there is scarcely a tree. So for hundreds of miles along the lake shore and inland, the timber has been cut away. The Mormons have, under their President, Brigham Young, planted a number of shade trees, but where a number of them have been set out, they are not higher than the houses. They have a number of fruit trees eighteen or twenty feet high. This is all the planting that the Mormons have done, and yet the lake is rising. I would like to ask, how is this, as well as that, accounted for?

Prof. J. HAMILTON. Mr. Meehan has well calculated that. Mr. Marsh, in his book on "Man and Nature," points to a district in France where once the country was densely populated and full of forests. For some purpose the French Government cleared off that district of timber, and in course of years the country became uninhabitable. The rains mostly ceased. If they did come, they came in tornadoes and hailstorms. The Government, years after, seeing this, I believe, that the cause was the taking away of the timber of the district, replanted the district again with timber, and to day the statement is that that district is again fruitful, and inhabited by a large number of citizens.

Now, what is the explanation of these facts, if they are facts, and the conclusion that is drawn, that the barrenness of this country is caused by the clearing away of the forests?

Mr. MEEHAN. There it is again; we will have to be there to investigate the trouble. I think the first trouble started from that work that is quoted from. I think, if gentlemen will study them, that many of these facts are dripts from newspaper reports, although I am a newspaper man myself, and that they have been extracted by the authors. Yet people will try some of the experiments spoken of by Mr. Marsh, even if they do not come out right.

A man tried a large tract of land with a rain gauge. He tried another gauge, and found more rain than in the other. So another man tried a pine forest, and the rain didn't fall so much there as somewhere else. So the conclusion is, you must grow an oak forest, instead of a pine forest.

As to the Government doing these things, you know that Governments often do very foolish things. Do the circumstances warrant the Government in doing them? You know that the Government of Switzerland once kept bears at the public expense. They found out afterwards that bears were expensive, and killed them, and found they got along as well as before.

D. WILSON of Juniata. Take the Genesee valley, nothing could live there, without fever and ague. Now that country is in living green, covered with beautiful villages and populous cities, and I am not aware that the Genesee is any lower, or that the water power is any lower than when the country was in forest. It used to be covered with forests, and was a marsh, to a great extent. Now it is a very fertile country, and yet the water power is as good as ever. Rochester was built by the strength of that water power. Now it seems to me that that contradicts your theory, Mr. Meehan.

The PRE-IDENT (Governor Hartranft). I would like to have a little further explanation upon one point. It is generally understood that the flow of water in the Susquehanna is much less during the summer



season, and is, perhaps, more in the winter, now than many years ago, and I think it is also true of the Schuylkill.

The same thing is said to be true in reference to many small streams. As I understand Mr. Meehan, he says these water courses are commonly influenced by geological reasons, and not because the water is held by the timber. Now, as to the rainfall, that is a question which I am perfectly satisfied with; but it does seem to me that the timber in the northern and western parts of the State, where it has been cut off, is, to some extent, the reason for the less flow of water along the Susquehanna, and some of these streams. When all these streams grow less, and the rainfall is the same, and no streams increase, there ought to be some other explanation where this water does go.

Mr. MEEHAN. I am very glad, sir, that you give me the opportunity to explain, for I did not intend to say that under no circumstances have forests had any influence whatever on the course of water, for they have, incidentally, although not a fundamental influence. For instance, if we have a sandy brink to a stream, and the trees are cut away, there will naturally be a greater wash and by tearing out, cause the water to find other streams. That is one way in which the cutting away of the trees has an effect.

Then trees on the mountain tops must necessarily tend to hold snow in greater quantities, and thus give the snow more time to melt; whereas if the timber is cut away, nothing prevents the snow running away, and its earlier melting, which makes the streams much higher and afterwards lower. That is the reason why.

My own effort is to show that they have no great fundamental interests in streams or springs; but of course in this and other similar ways they have. The cutting away of timber in the mountain tops would necessarily interfere with the streams.

The PRESIDENT (Governor Hartranft). Does heavy cannonading for a day, or two days, have any influence upon rainfall, in your estimation?

Mr. MEEHAN. I never could see how, unless it interfered with the currents, having the effect of drawing the warm currents and the cold currents together. But I could not depend upon that. I would like to be able to explain this more effectively.

THOMAS WARING. We know all the great battles of the country were generally followed by heavy rainfalls.

The PRESIDENT. Very frequently. I had generally to sleep out in those rains. I remember that quite vividly.

D. WILSON of Juniata. I am not satisfied, even dissatisfied. I want to hear more on this question.

A GENTLEMAN. I am a little like the German who heard one side: "I beleeves mit him." After hearing the other side, then he exclaimed: "And now I don't know mit whom to vote."

## FENCING AND FORESTRY.

By W. H. BLACK, *Floradale, Pa.*

[Read at the Gettysburg Institute.]

When our fathers began to build for themselves new homes in the new world, the whole country from the Ohio to the sea was an unbroken forest, a wild tangle of trees and briars and vines.

The men of to-day know only by tradition of the process and labor by which the land was cleared and brought under cultivation. The large trees were denuded of the bark in the spring, the undergrowth was cut and burned away, and a crop or two of corn was raised among the dead giants; then the trees were felled, cut into lengths, and, by the united efforts of the settlers, rolled into heaps and burned. The last-named operation, besides being the frolic of the season, afforded business opportunities. In our day and generation, we have no practical knowledge of any of this except of the "log-rolling," and that is attended to by the men who want to be sheriff or commissioner. But in that day the clearing of a farm was not only a great object in life, but was the labor of a life-time.

Such was the condition of things in Pennsylvania, when, in 1700, our present fence laws were passed. The destruction of the forests was an object, and the laws, though unjust in principle, were in harmony with that object. Now, when the preservation of the little remaining woodland has become a perplexing subject to all thoughtful men, these ancient laws remain a chief cause of the destruction to the forests. These laws compel a farmer to fence out his neighbor's stock, and if stock is injured by breaking into his field, the fence not being a "neighborly" one, the owner of the stock has a legal claim for damage. It has been well said that "if this law is based on equity, a man who does not secure his house with bolts and bars should be liable to punishment for placing temptation in the way of his neighbor." But whatever question there may be of the propriety of the law, there is none whatever as to its origin or its effects. When the law was passed there was not a single cleared farm in what is now Adams county, and forty years later there was not enough cleared land to furnish its inhabitants with bread. This was only one hundred and fifty years ago, and already the cry goes forth that in the destruction of the forests we have reached the *danger line*. A lumber famine there surely will be in the near future if there is not a more economic use of the material in sight. I think careful estimates will sustain the statement that of the land in wood twenty-five years ago, one-half is now cleared. The increase of population necessitating much building, and the introduction of portable sawmills are probably doing as much to hasten the final destruction of forests as the use of mineral fuel is doing to retard it.

The belief seems to be general that the clearing of the woodland is materially and dangerously changing the amount of rainfall. While it is not my purpose to discuss the climatic side of the forestry question, I will say that so far as the Atlantic slope is concerned, I do not fully share this fear. But to the regions west of the mountains the climatic question is of much importance. I lived long enough in the prairie States to note the gradual increase of rainfall induced by the



growth of hedges, orchards and shelter belts; and am well aware of the importance of wind-breaks. To prevent the wind from carrying off the moisture is the office of forests. The trees themselves take up the moisture and return it to the air more rapidly than it is given off by a cultivated field. The mountains shut us off from the prevailing westerly winds. While I have no figures to sustain my belief, and may be wrong in my estimate, I think we have still a sufficiency, and frequently an excess of moisture. But be that as it may be, if the clearing of woodland does not soon cease, there will be no woodland left to clear. One of the chief causes of the destruction of forests is the ever present necessity of keeping up fences. Let us pause a moment and see what it does amount to. A farm 80x160 rods contains 80 acres. It is divided into six fields, 40x53 rods, or about 13 acres each. With small enclosures, lanes and road fences equaling 160 rods of outside fence, and building one-half the line fences, such a farm will require 640 rods, or two miles of fence. 640 rods of seven-rail worm fence requires 9,000 rails, 9,000 rails at 60 to the cord equal 150 cords of wood. 9,000 rails at \$5.00 per 100=\$450 for material alone. The average price for post fence rails in thirty-six Pennsylvania counties is \$7.00 per 100. It will require 1,060 panels to enclose 80 acres as above, which, if five rails high, will cost, at seventy cents, \$742, or nearly \$10 per acre. If we consider the average life of rails and posts to be 33½ years, the farmer, to say nothing of the original investment, must pay three per cent. at least for repairs on any kind of fence, or at the rate of thirty cents per acre. This is a heavy tax on the farmer and on the forest. When these fences are constructed, they are a constant source of worry. The winds blow them down, and stock breaks or pushes them down. They harbor weeds and vermin. They are unsightly to all eyes not accustomed to their ugliness.

Of course, the most beautiful fence, if the word may be applied to any fence, is the live fence—the hedge. But there are many objections to that. It, too, harbors weeds and vermin, and, while the first cost is small, it requires more labor than any other fence. Then, because it cannot be moved, it is only suitable for line and road fences. And it is objectionable along roads, as, even when kept down to a proper height, it holds the drifting snow and blockades the roads. It also injures light soils adjacent to it.

We cannot do as in China and in parts of Germany and France, where there are no fences. The herder boy, with his dog and pony, is too expensive on small farms, and is unreliable anyhow. The soiling system may probably some day solve the problem, but it wins its way slowly.

The fence of the future in all probability is the wire fence. But there are two causes working together to prevent its general use. The first is that it is not a legal fence. It can be made a legal fence. The other is popular prejudice. This will not be so easily remedied, and having seen some so-called wire fences in this county, I do not wonder that they are not in favor. The weather being dry and pasture failing, neighbor H—— concludes he must fence off the lower meadow, but as it is a busy season, he will make it of wire and save time and labor. So he sets a few posts, thirty or fifty feet apart, and strings on two or three wires, without any stays, turns in his cattle, and goes on with the plowing. All goes well for a while, but the dry weather soon checks the green posts and some of the staples that were driven "straight" fall out; the wires sag down, and a favorite colt or heifer

gets fast or hurt. It is always the favorite that gets hurt. The neighbors see the damage but not the fence. The correspondent of the local press makes an item of the accident, calls the structure a *fence*—which it is *not*—and the people all along the line shake their heads and say: "Wire fences are dangerous things."

Such fences are dangerous.

I lived for years in a section in which at least ninety per cent. of the fences are of wire, and saw the evolution of the wire fence, from the single unbarbed wire of 1870 to the barbed cable and buckthorn of to-day; and in all that time I can recall but one accident which was not due to carelessness in construction or in keeping in repair, and even that case resulted from lack of judgment. A cow, answering the call of her calf, crossed the corral fences to the barn. Wire fence is not suitable for small enclosures about buildings, nor for division fences between pastures, as cattle may lock horns through the wire and be hurt. Accidents may result, too, from having wire fences under shade trees where horses and cattle spend the heat of the day. But I have not known accidents to occur from either of the latter causes.

A well-constructed wire fence has many advantages over any other fence.

*First.* It is stock proof to any kind of stock that should be at large or in pasture.

*Second.* It is easily kept clear of weeds and does not harbor vermin.

*Third.* It does not cause the blockade of roads by snow-drifts.

*Fourth.* It is more durable.

*Fifth.* It is less costly.

*Sixth.* If a post breaks off it does not pull the fence down. The fence holds the post up, and the post is easily replaced.

*Seventh.* It requires but little lumber, and therefore does not do much toward the destruction of forests.

At the risk of making this paper too lengthy for either your time or patience, I will give the plan and cost of eighty rods of what I regard as a well-constructed wire fence.

Eighty rods of fence with posts forty-one and one-fourth feet apart, will require two king posts of extra size and length, one large middle post and thirty small posts. The common posts need not be more than half as large as those used for rail fence. Large posts in wire fence are unsightly and are said to be less durable than small ones.

The king post should be set at least four feet in the ground, and there should be pins through the lower ends to prevent the posts being hoisted by the frost or by the contraction of the wire. The king posts and the middle posts should be well braced. The wires should run to the center of the king posts. If fastened to the side the posts may turn and the fence will slack. There should be a few panels of rail fence where fences join. It may be necessary to go through with the binder or sleigh.

Four wires are sufficient where there are no sheep. The wire should be of buckthorn or good cable barbed. Single wires are not good; they sag in warm weather and snap in cold. There is enough spring in cable, and I believe in buckthorn, to take up the slack.

Stays, about one and one-fourth by one and one-fourth inches and three and one-half feet long should be stapled to the wire at intervals of four feet. These should not reach the ground, as they would prevent the mower being run under the fence.



The stays are indispensable. At least ninety per cent. of wire fence accidents result from stock forcing through fence not stayed.

To prevent horses from running against the fence, plaster lath should be wired below the upper wire. Don't use anything heavier. The stays and top lath should be well limed before they are put on. Punch the lath with a shingle punch. To lime, soak a bundle or two in white wash, in a trough, and set up with tongs to dry. Stock will not run against such a fence day or night.

Eighty rods of such fence will cost:

For three large posts, . . . . .	\$1 00
For four braces, . . . . .	50
For thirty small posts at ten cents, . . . . .	3 00
For three hundred stays at one cent, . . . . .	3 00
For three hundred and thirty-four feet plaster lath at thirty cents per one hundred, . . . . .	1 00
Five thousand two hundred and eighty feet or four hundred and forty pounds of buckthorn at five and one-half cents per pound, . . . . .	24 20
Staples, tie wire, lime, etc., . . . . .	3 30
Labor, two men two days, . . . . .	4 00

Total, . . . . . \$40 00

Or an average of fifty cents per rod.

The average cost of four-rail fence in thirty-six counties, is sixty-three cents per panel of ten and one-half feet, or just ninety-nine cents per rod. Four-rail post fence costs about twice as much per rod, as four-wire fence as described. I have seen it estimated that wire will last from sixty to ninety years, but it will take seventy or eighty years to prove that. But the posts in a wire fence not being mortised, and not being strained by the wind or carrying much weight, will not rot off or break off so soon as the posts will in a post and rail fence. It seems clear to my mind that the general use of wire for fence will not only give more reliable and cheaper fence, but will do much toward the preservation of the forests.

#### REPORT OF THE COMMITTEE ON FORESTS AND FORESTRY.

By DR. W. S. ROLAND, *Chairman, York, Pa.*

[Taken from the Annual Report of 1882.]

In the preparation of a report on a subject so varied and extensive as the one which has been referred to your committee, many suggestions, declarations and statistics, may be embraced which are not new, and much of it may be only a repetition of what has often heretofore been said and written.

The resources of the State are invaluable, and the people generally are intelligent, persevering and prosperous; ever on the alert in active industry and boldness of enterprise, and in the pursuit of valuable knowledge, they are well calculated to take care of their own interests as well as to advance the general welfare of the Commonwealth. They are governed and protected by good and wholesome laws, and have most excellent opportunities for pursuing scholastic attainments in the various professions, arts, tastes, and occupations, all

of these studies so important and absolutely necessary to a successful economy of human existence; and thus whilst it can be proudly said of our people that they surely are on the high road to prosperity and a safe future, it must not be forgotten that in all departments of industry there are often serious drawbacks which are sure to come sooner or later, but which may be averted in time if the necessary precautionary means are brought into timely use, and perhaps the foremost and most serious of these drawbacks will be found in the great demand, as well as in the rapid destruction, from various causes, of the large timber areas throughout the State. This great demand, and too often absolute waste, is getting to be a growing evil, and the people may well stop and think over it, for unless there is greater care and better protection in meeting these demands on our forests, by encouraging and increasing forest growth, they will see that at no distant day the trees will be gone, the demand increased, occupations lessened, and the people suffering for want of that employment and protection which the forests alone can give.

The vast and increasing importance of this subject, the value and necessity of caring for the timber of the State, may well be classed in that list which requires close observation, careful investigation, and reliable statistical information, on which to base a satisfactory report.

The fact of the rapid deforestation of large areas, and the expression of fears of a possible timber famine in the near future, is beginning to enlist the fears and excite the attention of the people. As the population increases, business of all kinds advances, and this is, perhaps, more particularly noticed in our manufacturing operations than in any other branch of industry; and to meet these demands at home and abroad, suitable timber in large quantities is all the time needed, and, as a matter of course, it will all the time be getting scarcer and dearer, thus requiring much effort, time and care, with judicious management, in promoting forest culture. To meet these constant demands for the supply of wood, it is confidently hoped that experimental experience in forest culture will in time teach the people that it can be made as remunerative as any other branch of industry, and that they will ultimately learn that we can produce our wood and timber supplies as surely and profitably, though with not so frequent harvests, as we can grow our grain and meat supply.

All kinds of trees can be utilized, and hence, in forest culture, the people should know which kinds can be best and most profitably grown in certain soils and localities. Investigations leading to the fullest development of the resources of the State, in the business of forestry should be encouraged, and the necessary aid should be proffered for the discovery of the best method of management, and for the protection and preservation of our wasting forests; for there are few subjects so closely connected with the wants of society, the general health of the people, the salubrity of our climate, the production of our soils, and the increase of wealth, as our forests afford. Therefore, entertaining and acting on the views as herein expressed, the committee had printed about three hundred circulars, and mailed from three to five copies of the same to various parties, in every county of the State. The following is a copy of that circular:

1. How much old timber is there in your county? 2. How much young timber to replace the old? 3. What kinds grow best? 4. What kinds are most in demand? 5. What soils are best adapted to certain kinds? 6. Can the cultivation of timber be made profitable? And



please give your experience and opinion in forest culture. 7. Would the introduction of varieties from adjoining counties or States, or from other countries be of profit to your locality? If so, what kinds do you consider the best to introduce? 8. What do you consider the best protection against forest fires? 9. To what extent have the people of your county taken advantage of the law providing for the planting of trees along the highway? 10. What kind of legislation do you deem best adapted to the needs of the case?

The committee would request that you make your answers to these queries as full as you can, and that you refer therein to the queries by the number here given.

Respectfully, on behalf of the committee,  
W. S. ROLAND,  
*Chairman.*

Over one hundred correspondents throughout the State returned answers to the above questions, from which the following extracts and deductions are made. NOTE.—When there is more than one report from a county, it is indicated by \*.

QUESTION 1.—How much Old Timber is there in your County?

ADAMS—One-fourth. ALLEGHENY—One-tenth. ARMSTRONG—Two-fifths. BEAVER—From one-tenth to one-fifteenth. BEDFORD—One-tenth. BERKS—About one twentieth. BLAIR—One-fourth. BRADFORD—One-fifth. BUCKS—One-sixth. BUTLER—From one-sixth to one-tenth. CAMBRIA—Not over one-seventh of the original growth. CAMERON—Not reported; estimated at more than one-half. CARBON—Not reported; estimated at more than one-third. CENTRE—About ten per cent. of original growth. CHESTER—Less than one acre in five hundred acres of general area. CLARION—Not reported; estimated at one-fourth of area. CLEARFIELD—Not reported; estimated at one-third of area. CLINTON—Estimated at one-sixth of the area of the county. COLUMBIA—Estimated at one-third of the area of the county. CRAWFORD—From one-fifth to one tenth. CUMBERLAND—About one-tenth. DAUPHIN—Estimated at one-fifth. DELAWARE—About one-sixth. ELK—About one-half. ERIE—From ten to fifteen per cent. FAYETTE—Average about one-third of the original growth. FOREST—One-half of the county. FRANKLIN—One-fourth, including mountains. FULTON—Not reported; estimated about one-third. GREENE—Probably one-fourth. HUNTINGDON—About two-fifths. INDIANA—Will average one-third. JEFFERSON—Nearly one-half. JUNIATA—Nearly one-third. LANCASTER—About one-tenth. LAWRENCE—From fifteen to twenty per cent. LEBANON—About one-third. LEHIGH—About one-fifth. LUZERNE—Average about one-third. LYCOMING—Average about one-third. LACKAWANNA—Not estimated; reporter says the timber has been slaughtered. MCKEAN—From one-half to two-thirds of the original forest. MERCER—Supposed to be less than one-fourth. MIFFLIN—Probably one-fourth. MONROE—Not reported; estimated at one-third. MONTGOMERY—About one-thirtieth. MONTGOMERY—About one-eighth. NORTHAMPTON—About one-thirtieth. NORTHUMBERLAND—About one-twelfth. PERRY—Estimated at one-fifth. PHILADELPHIA—About one hundred acres in the whole county. PIKE—Very little of the original growth. \*About 50,000 acres of pine. POTTER—Three-fourths. SCHUYLKILL—Not reported; estimated about one-fourth of the area. SNY-

DER—One-third of the land of the county. SOMERSET—About one-third. SULLIVAN—About one-half. SUSQUEHANNA—About one-third. TIOGA—Estimated one-third. UNION—Estimated one-fifth. VENANGO—Estimated one-third. WARREN—About one-third. WASHINGTON—Ten per cent. of area. WAYNE—Estimated at about one-fourth. WESTMORELAND—About 135,000 acres. \*About ten acres in every one hundred. WYOMING—About one-third. YORK—About one-fifth.

QUESTION 2.—How much Young Timber to replace the Old?

ADAMS—Considerable sprouting of young timber. ALLEGHENY—None planted. ARMSTRONG—Sufficient growing. BEAVER—Very little. BEDFORD—Scarcely any. BERKS—Twenty-five per cent. of the area of old timber. \*Chestnut, with some little white oak, will be our only supply. BLAIR—About three-eighths of the square miles in the county. BRADFORD—Only a very small amount. BUCKS—Very little. BUTLER—About one-twenty-fifth per cent., to take the place of the old timber. CAMBRIA—Considerable young chestnut and locust sprouts. CENTRE—About forty per cent. \*There is considerable mountain land in young timber, but fires destroy it every few years. CHESTER—About seventy-five per cent. of stump land is allowed to grow up in timber. \*Probably one acre to every ten of plowed land, and consists mostly of chestnut. CLINTON—Probably one-tenth of the area of old timber. \*None except the natural growth. COLUMBIA—Very little. CRAWFORD—None worth mentioning. CUMBERLAND—None. \*As much growing as being cut. DAUPHIN—None but mountain sprouts. DELAWARE—One per cent. ELK—None worth mentioning. ERIE—None, or very little. FAYETTE—None of any account. FOREST—About one-fourth of the timber area. FRANKLIN—None, except on mountains. GREENE—Little of value. HUNTINGDON—None, except what springs up spontaneously. INDIANA—None, except what springs up spontaneously. JEFFERSON—Very little, or none. JUNIATA—None in the valleys; some spontaneous growth on mountains and ridges. LANCASTER—Very little. LAWRENCE—None. LUZERNE—Not any. LEBANON—Inclose and protect the sprouts from cattle, and time will replace it. LYCOMING—Some young timber growing with the old in some places. LACKAWANNA—Very little. MCKEAN—None of any amount. MERCER—If left to grow, time would replace the old. MIFFLIN—Considerable on the mountains. MONTGOMERY—None. MONTGOMERY—About one-eighth of the timber area. NORTHAMPTON—Very little. NORTHUMBERLAND—Some chestnut sprouts. PERRY—None, except spontaneous growth. PHILADELPHIA—None. PIKE—There is some; cannot tell how much. POTTER—None. SNYDER—About one-ninth of old timber area. SOMERSET—Only to a limited extent. SULLIVAN—About ten per cent. growing up again. SUSQUEHANNA—None planted. TIOGA—None, or little to supply future demand. UNION—None, or very little. VENANGO—As much as there is old. WARREN—There is a little young timber, about five per cent. WASHINGTON—Very little. WAYNE—Considerable. WESTMORELAND—None in settlement; considerable young chestnut on the ridges. WYOMING—Very little, about one-tenth of old timber area. YORK—About one-twentieth, chiefly young chestnut and locust.



**QUESTION 3.—What Kinds Grow Best ?**

COUNTIES.	White oak.	Black oak.	Rock oak.	Oak.	Chestnut.	Hickory.	Black walnut.	Locust.	Pine.	Hemlock.	Ash.	Poplar.	Beech.	Maple.	Elm.	Bass.	Other varieties.
Adams,	0		0		0	0		0									
Allegheny,	0						0				0			0	0		
Armstrong,				0	0	0											
Beaver,	0							0						0			
Bedford,	0				0			0			0						
Berks,	0				0				0								
Blair,	0		0	0	0			0									
Bradford,				0	0				0	0						0	0
Bucks,	0				0									0			
Butler,	0				0		0				0			0			
Cambria,					0				0	0							
Centre,					0			0	0								
Chester,	0	0			0		0						0				
Clinton,					0				0	0							
Columbia,			0	0													
Crawford,				0	0		0		0	0	0	0	0	0	0		0
Cumberland,	0	0				0			0								
Dauphin,					0			0									
Delaware,				0	0	0		0									
Elk,									0								
Erie,				0	0	0	0		0	0	0	0	0			0	0
Fayette,				0	0	0		0					0				
For st,					0					0	0	0					
Franklin,				0	0	0	0	0									
Greene,				0			0	0				0					
Huntingdon,	0				0			0	0	0							
Indiana,	0			0	0		0	0	0	0				0			
Jefferson,	0				0		0		0								
Juniata,				0	0		0										
Lancaster,					0			0									
Lawrence,	0	0		0	0		0				0	0	0	0			
Lebanon,	0		0		0		0	0									
Luzerne,										0							
Lycoming,				0		0	0										
Lackawanna,					0	0	0			0				0			
McKean,				0		0			0					0			
Mercer,				0					0	0	0		0	0			
Mifflin,					0	0		0	0		0		0	0			
Montgomery,	0	0		0													
Montour,				0	0												
Northampton,	0	0	0		0		0										0
Northumberland,	0				0												0
Perry,	0		0			0	0	0									
Philadelphia,																	
Pike,				0	0				0	0			0	0			
Potter,				0	0				0	0			0	0			
Snyder,				0	0					0	0						0
Somerset,				0	0	0			0								
Sullivan,					0				0	0	0			0			0
Susquehanna,					0					0	0			0			
Tioga,				0					0	0			0	0			0
Union,					0												
Venango,	0	0			0			0	0					0			
Warren,				0	0					0	0						
Washington,	0					0				0	0						
Wayne,								0	0	0	0		0	0	0		
Westmoreland,	0	0			0	0	0	0		0	0	0	0	0	0		
Wyoming,				0	0	0				0			0				
York,	0		0		0	0	0	0									0

**QUESTION 4.—What Kinds are Most in Demand?**

COUNTIES.	White oak.	Black oak.	Rock oak.	Oak.	Chestnut.	Hickory.	Walnut.	Locust.	Pine.	Hemlock.	Ash.	Poplar.	Beech.	Maple.	Elm.	Bass.	Other varieties.
Adams,	0		0		0	0		0									
Allegheny,																	
Armstrong,				0	0		0										
Beaver,	0							0									
Bedford,	0				0			0									
Berks,	0																
Blair,				0	0			0	0	0							
Bradford,					0	0				0							
Bucks,	0				0	0	0					0					
Butler,	0				0	0											
Cambria,	0				0	0			0	0	0						0
Centre,	0				0			0	0	0					0		
Chester,	0			0		0		0									
Clinton,					0			0									
Columbia,	0				0					0							
Crawford,				0	0				0	0		0	0		0		
Cumberland,	0				0	0			0								
Dauphin,	0				0				0								
Delaware,	0				0			0									
Elk,									0	0	0	0					
Erie,				0	0	0		0		0	0		0		0		0
Fayette,				0				0				0					
Forest,				0					0								
Franklin,	0		0			0											
Greene,				0				0									
Huntingdon,	0		0		0	0		0	0	0	0	0					
Indiana,	0				0	0		0	0	0							
Jefferson,				0				0									
Juniata,					0						0						
Lancaster,					0			0									
Lawrence,	0			0		0			0		0						
Lebanon,	0	0			0	0	0	0									
Luzerne,					0					0							
Lycoming,										0							
Lackawanna,				0	0	0	0		0	0	0		0				
McKean,										0	0						
Mercer,				0									0				
Mifflin,				0	0	0			0						0		
Montgomery,	0				0					0							
Montour,					0												
Northampton,	0	0			0	0	0										
Northumberland,	0				0												
Perry,	0				0	0											
Philadelphia,																	
Pike,				0	0				0	0							
Potter,						0			0	0	0						
Snyder,				0					0								
Somerset,					0					0	0						
Sullivan,					0				0	0	0				0	0	
Susquehanna,									0	0	0						
Tioga,				0	0				0	0	0						
Union,	0		0		0				0								
Venango,	0				0												
Warren,				0	0		0		0	0	0						
Washington,	0					0			0				0			0	
Wayne,					0					0	0	0		0	0		
Westmoreland,	0					0	0	0		0	0						
Wyoming,				0	0	0			0	0						0	
York,	0		0		0	0	0	0	0	0		0					

**QUESTION 5.—What Soils are best Adapted to certain Kinds ?**

ADAMS—Low clay for white and rock oak, high gravel for chestnut. ALLEGHENY—Our soils are adapted to the growth of all kinds, except pine and hemlock. ARMSTRONG—Low land for oak; upland for chestnut. BEAVER—Clay for oak, high land for locust, and rather wet and sandy for pine and maple. BEDFORD—Heavy soil for white oak; light and sandy for chestnut and locust. BERKS—Heavy clay for hickory and oak, and a light soil for chestnut. BLAIR—Gravel and black slate for chestnut, locust and oak. BRADFORD—Shales. BUCKS—Deep clay for white oak.



and hickory; gravelly for chestnut. BUTLER—Sandy loam for hickory and chestnut; clay for ash and walnut. CENTRE—Sandy and slate for pine, and chestnut, and locust; limestone and rich table land for oak, hickory and walnut. CHESTER—Rich table land for hickory, walnut and oak; slate and gneiss for chestnut. CLINTON—Light mountain for white pine and chestnut; limestone for oak, hickory and walnut. COLUMBIA—Chestnut on the ridges; pine, hemlock and oak in the lowlands and swamps. CRAWFORD—Gravel, loam and clay subsoil for oak, chestnut, beech and maple; lowlands of deep alluvial character for pine, bass, cucumber, &c. CUMBERLAND—Limestone for oak, hickory and locust; gravel for pine and chestnut. DAUPHIN—Mountain soil for chestnut and locust. DELAWARE—Light soil for chestnut; heavy rich for locust and walnut. ELK—Any soil not wet. ERIE—Clay bottom for oak, hickory, walnut and hemlock; gravel and sand for chestnut, maple, poplar and cucumber. FAYETTE—Rich loams for walnut, locust and poplar. FOREST—Clay and hard pan for oak and pine; limestone for white oak. FRANKLIN—Limestone and black slate for white and rock oak, hickory and walnut; sandy for chestnut. GREENE—Heavy clay for oak and loamy for walnut and poplar. HUNTINGDON—Clay and limestone for oak; mountain ridges for rock oak, chestnut and locust; low, rich land for walnut and all other kinds. INDIANA—Heavy soil for oak, walnut and hickory; gravel and sand for chestnut and pine. JEFFERSON—Rich loam for walnut and white oak; light for chestnut; any soil for pine. JUNIATA—Sandy for chestnut; limestone and clay for other kinds. LANCASTER—That depends on the kind of timber. LAWRENCE—Clay for the oaks; gravel for chestnut; rich loam for walnut; moist bottom for pine, maple, &c. LEBANON—Limestone for oak, and walnut, and hickory; gravel for chestnut; sandy for locust. LUZERNE—Clay for growth of our timber. LYCOMING—Our soil is adapted to all kinds. LACKAWANNA—Mountain soil for oak and pine; bottom lands for white ash, walnut, hickory, &c. MCKEAN—Soil makes no difference. MERCER—High and gravelly for oak and chestnut; low clay and sand for hemlock and maple. MIFFLIN—Sandy for pine, chestnut, locust and oak; limestone clay for hickory. MONTGOMERY—Slate hills for chestnut; clay soils for oaks. MONTGOMERY—Gravel for chestnut; clay for white oak. NORTHAMPTON—Clay and limestone for white oak, hickory and walnut; gravel and slate for chestnut, and pine, and maple. NORTHUMBERLAND—Uplands for chestnut; side hills for white oak and spruce. PHILADELPHIA—No report. PERRY—Gravel and limestone for walnut, chestnut, oak and locust; bottom lands for hickory. PIKE—What we call beech soil. POTTER—Not any especially distinct from other kinds. SNYDER—Light for chestnut; heavy for oak. SOMERSET—Clay for oaks; sandy for chestnut; wet and sandy for pine. SULLIVAN—Dry, rolling ridges for hard wood; low, murky for hemlock. SUSQUEHANNA—Clay subsoil for hemlock, maple, chestnut, ash, &c. TIoga—Mountainous for pine; swamp for ash; table land for maple and beech. UNION—Clay bottom for oaks; any good soil for chestnut and locust. VENANGO—Clay, gravelly loam for chestnut, oak and other varieties. WARREN—High and rolling for the oaks, maple and bass; low and swampy for ash, &c. WASHINGTON—Clay and limestone for most thrifty timber. WAYNE—Low lands for pine and hemlock; high lands for hard wood. WESTMORELAND—Any limestone and sandy soil for oak, walnut and locust. YORK—Limestone and clay for oaks, hickory and walnut; sandy and slate for locust, chestnut and pine.

## QUESTION 6.—Can the Cultivation of Timber be made Profitable.

ADAMS—No. ALLEGHENY—Yes; locust and maple. ARMSTRONG—No. BEAVER—Yes; locust and maple. BEDFORD—Think it can. BERKS—Not in this; experience none. \*Chestnut might be. BLAIR—It can if measures are devised to protect it from fires. BRADFORD—It can. BUCKS—Think it could to a certain extent. \*Think not, as it is of such slow growth. BUTLER—Yes; chestnut, hickory and locust. CENTRE—Think not, as we have an abundant supply and taxes are too high. CHESTER—Yes; if there is a will to plant and nurse young trees; there are plenty of tulip poplars and chestnuts and other trees known to me that are valuable. CLINTON—Not except it be chestnut or locust. COLUMBIA—Have no experience. CRAWFORD—Think not; the native varieties properly cared for could be made profitable. CUMBERLAND—Our limestone land is too high-priced to appropriate for that purpose. DAUPHIN—Cannot answer. DELAWARE—Think not; our lands are too high-priced. ELK—No. ERIE—I venture to say it could be. \*Not so long as other places furnish cheap lumber. FAYETTE—Think locust and walnut would pay. FOREST—Cannot say as we have plenty. FRANKLIN—Think not. GREENE—Think not. HUNTINGDON—Do not think it could. \*It can; speak from experience. INDIANA—Exceedingly doubtful. \*It could be, particularly walnut. JEFFERSON—In my opinion it can; white pine, chestnut and black walnut grow very rapidly, and their annual growth would yield a good percentage. JUNIATA—It would not. LANCASTER—Not in our county where land is so high-priced. LAWRENCE—Cultivation of locust and chestnut could be made profitable. LEBANON—Chestnut and locust can be made profitable, because of their rapid growth. \*Certainly, and the time is at hand, when necessity, as well as profit, will stimulate its culture. LUZERNE—Do not think it could be. LYCOMING—Think not, as timber is too cheap in the north-west. LACKAWANNA—Think it can; have cultivated sugar maple and walnut with success. MCKEAN—It could be if protected against fires. MERCER—No experience. MIFFLIN—Think locust could be. MONTGOMERY—Think not. MONTGOMERY—No experience. NORTHAMPTON—No experience. \*Locust and walnut, in my opinion, can. NORTHUMBERLAND—It can where land is not too high-priced. PERRY—Think not. PHILADELPHIA—No report. PIKE—No; our population is too much scattered and fires too destructive. POTTER—Has not been tried. SNYDER—It cannot. SOMERSET—Yes; decidedly; maple, locust and walnut have been grown successfully. SULLIVAN—Think it can; have some experience in walnut and chestnut. SUSQUEHANNA—No; not yet. TIoga—No. VENANGO—No. \*Think it could. WARREN—It can, and speak from experience. WASHINGTON—No sir. WAYNE—It can, for I know it from observation and experience. WESTMORELAND—It might, through the aid of legislative action. WYOMING—Think it can; have some experience with locust and sugar maple. YORK—It can.

## QUESTION 7.—Would the Introduction of other Varieties be Profitable?

To this question nearly all of the correspondents return a negative answer. The few exceptions are, that possibly walnut, locust, chestnut, oak, hickory and pine, in the order in which I have named them, could be introduced and grown with profit.



**QUESTION 8.—What do you Consider the best Protection against Forest Fires?**

ADAMS—A reward for the arrest and conviction of offenders. ALLEGHENY—A law making it a penal offense to shoot game in the forest during a season of great drouth. ARMSTRONG—A good shower of rain. BEAVER—Clear away the underbrush, grass will spring up, then pasture with sheep. \*Plowing around the inclosure and sowing in grass. BEDFORD—Fire from railroad engines are the most annoying; there should be a law to punish railroad companies for all damage done. BERKS—Have some better restrictions on railroad companies. \*County commissioners to appoint persons to put out fires and pay them. BLAIR—The appointment of a competent wood-ranger or forester to each township who shall have power to employ help when fires happen. BRADFORD—Organizations of able-bodied men to put the fires out. \*Burn away the leaves and underbrush, then fires will not do much injury. BUCKS—We have no forest fires. BUTLER—We are not much troubled with forest fires. CAMBRIA—Stringent laws with heavy penalties. CENTRE—Remove the underbrush from amongst the timber. \*Proper restraint on railroad companies and punish individuals. CHESTER—Require railroad companies to clear at least two perches in width beside their roadway and get rid of all the tramps. CLINTON—Land cleared from railroads; proper legislation. COLUMBIA—The fire from locomotives is invariably the cause of fires in this county. CRAWFORD—Railroad locomotives are the principal sources of danger, and farmers burning brush, and careless hunters. CUMBERLAND—Very stringent laws. DAUPHIN—Watchfulness on the part of landholders. DELAWARE—No fires in this section. ELK—Nothing to recommend. ERIE—Not troubled much. FAYETTE—Vigilance and work to put them out. FOREST—Shoot the aggressor. FRANKLIN—Punish offenders. GREENE—A law making the owner of premises from which the fire escapes responsible for damages. HUNTINGDON—Watch it closely and put it out before it gets headway. INDIANA—The enforcement of the law for protection of timber. \*Hang the tramps. JEFFERSON—Remove from the ground all combustible materials on which fires feed. JUNIATA—No plan to suggest. LANCASTER—Not much trouble with them. LAWRENCE—Pray for rain. LEBANON—A law authorizing the county to appoint three watchers in each township, a vigilance committee with plenty of rope to hang every incendiary. \*Greater care in having spark arresters on railroad locomotives. LUZERNE—Hard to answer. LYCOMING—Greater care on part of railroad companies, and removal of rubbish from road sides. LACKAWANNA—A vigorous prosecution of the law. MCKEAN—A law making persons liable for damages caused by building fires in the woods; also hold railroad companies liable for fires caused by locomotive sparks. MERCER—Sensible people and plenty of rain; law penalties might help. MIFFLIN—Divide timber land into small tracts, and owners guard it. MONTGOMERY—Not troubled with them. MONTOUR—Stop sportsmen from hunting, and compel railroad companies to pay all damages done by them. NORTHAMPTON—Carry out the laws better, and there will be less fires. NORTHUMBERLAND—No protection would be needed if the sparks from railroad engines did not cause the fire. PERRY—Heavy penalty laws. PHILADELPHIA—No report. PIKE—Clearing the land surrounding the woods. \*Severe punishment for tie stealers. POTTER—Great care in putting out and keeping fires under control. SNYDER—Have spaces cleared in the woods. SOMERSET—Make wide roads through timber lands. \*Stringent laws, and have them enforced. SULLIVAN—Put the

laws in force, and if not severe enough enact others. \*More stringent laws against burning underbrush when clearing land. SUSQUEHANNA—Protection from sparks of railroad engines, and a less use of matches. \*The hangman's rope. TIOGA—Honesty; for the lack of it, a statute with a severe penalty. \*Continuous wet weather. UNION—A still more stringent law; and prevent deer-hunting with dogs. VENANGO—Stringent laws, and better protection from railroad locomotive sparks. WARREN—Clean ground, eternal vigilance, and plenty of water. WASHINGTON—Not troubled with them. WAYNE—The statute law passed in 1879. WESTMORELAND—Keep the ground clean of leaves. WYOMING—Greater care, and a stricter enforcement of the laws. YORK—Better security against locomotive sparks, and from hunters and tramps.

**QUESTION 9.**

A very large number of the correspondents in answer to this question, report that no trees have been planted along the highways, whilst a few others report that the law is observed only to a very limited extent. The conclusion, therefore, is that the law is not generally known, or if known, is not obeyed.

**QUESTION 10.—What Legislation is Required?**

This question, judged by most of the answers, does not seem to have been properly understood by many of the correspondents. We extract the following from some of the replies, without designating counties:

"England has a law governing the case, why not copy it?" "We have too much legislation not enforced." "A general act to prevent cattle from running at large." "A reduction on road tax." "Exempt all well-kept timber lands from taxation." "We are not yet ready to adopt the European system of forest laws." "Adopt a good forestry law." "Do not think any legislation necessary." "Make it a criminal offense to turn out cattle to browse." "A premium for planting and cultivating trees." "Laws encouraging the planting of trees." "Require county commissioners to publish in the county papers all laws now in force, relating to the subject," &c.

**List of Contributed with their Post-Office address.**

ADAMS—E. Maginly, Fairfield. ALLEGHENY—John R. McMichael, Beach Cliff. ARMSTRONG—S. Hamilton, Oakland. BEAVER—John Dillon, New Gallilee; J. S. Elder, Darlington. BEDFORD—W. C. Lutz, Bedford. BERKS—F. B. Hassler, Hamburg; J. G. Zerr, Geiger's Mills. BLAIR—John A. Lemon, Harrisburg. BUCKS—David McNair, Richboro'; Eastburn Reeder, New Hope. BUTLER—A. D. Weir, Freeport; James D. Lytle, Harmony; J. P. Robinson, Glenora. BRADFORD—James Macfarlane, Towanda; A. T. Lilley, Le Roy. CAMBRIA—John Beaver, Carroltown; Alva Akers, Johnstown; J. P. Stalb, Grant; James J. Cayler, Ebensburg or Loretto. CENTRE—D. Weiland, Linden Hall; J. A. Hunter, State College; John Hamilton, State College. CHESTER—W. R. Shelmyer, Avondale; Dr. John P. Edge, Downingtown. CLINTON—, North Bend; J. A. Herr, Cedar Springs. COLUMBIA—, Buckhorn. CRAWFORD—J. S. Kean, Evansburg; A. N. Perrin, Titusville. CUMBERLAND—Hon. Fred'k. Watts, Carlisle; G. R. Dykeman, Shippensburg. DAUPHIN—Henry Hartman, Berrysburg. DELAWARE—Thomas Speakman, Brandywine Summit. ELK—John C. McAllister, Brandy Camp; J. W. Gray, Benezette.



ERIE—J. Miles, Milesgrove; William M. Brown, Erie. FAYETTE—William Beesom, Uniontown. FOREST—W. P. Siggins, West Hickory. FRANKLIN—John Webster, Mercersburg. GREENE—B. H. Clark, Waynesburg. HUNTINGDON—S. McVittey, Saltillo; C. Wakefield, Allenville; R. McDevit, Huntingdon; Livingston Robb, McConnells-town. INDIANA—George W. Hood, Indiana; W. T. Work, Brady; P. M. Hodge, Blairsville. JEFFERSON—J. B. Conser, Punxsutawney; ———, Brookville. JUNIATA—W. Banks, Mifflintown. LANCASTER—Johnson Miller, Lititz. LAWRENCE—J. M. Lawrence, Plain Grove; H. C. Falls, New Castle. LEBANON—A. Wilhelm, Cornwall; George W. Kline, Lebanon. LUZERNE—John B. Smith, Kingston. LYCOMING—M. P. Hepburn, Jersey Shore. LACKAWANNA—J. D. Cramer, Carbondale; ———, Ransom. MCKEAN—C. Smith, East Valley; D. Sampson, Jr., Turtle Point. MERCER—Samuel Coleman, Centreton. MIEFLIN—Joseph Campbell, Bellville. MONTGOMERY—William H. Holstein, Bridgeport. MONTGOMERY—L. L. Sechler, Danville. NORTHAMPTON—J. J. Ealer, Easton; A. D. Shimer, Bethlehem. NORTHUMBERLAND—J. F. Derr, Sunbury. PERRY—D. B. Milliken, Landisburg. PHILADELPHIA—Thomas Meehan, Germantown. PIKE—E. J. Baker, Milford; William Cromwell, Hawley. POTTER—J. W. Allen, Coudersport; J. E. Harvey, West Bingham. SNYDER—Philip Hilbush, Selinsgrove. SOMERSET—J. W. Hay, Elk Lick; John W. Beachy, Elk Lick; C. C. Musselman, Somerset. SULLIVAN—Benjamin Vaughn, Sciota Vale; Lyman B. Speaker, Hillsgrove; Richard Bedford, Campblesville. SUSQUEHANNA—John C. Morris, Friendsville; L. T. Birchard, Birchardville. TIOGA—Lafayette Gray, Mainsburg. UNION—John R. Follmer, Allenwood. VENANGO—William Gates, Rockland; J. P. Byers, Cooperstown; James Russel, Polk. WARREN—G. P. Meade, Youngsville; Daniel Lott, Lottsville; F. R. Miller, Sugar Grove. WASHINGTON—H. C. Slusher, Sunset or Lone Pine. WAYNE—E. W. Hamlin, Bethany; T. J. Crocker, Boyd's Mills; L. T. Underwood, Lake Como. WESTMORELAND—John Beaty, Beaty; Hortensius Lowry, West Newton. WYOMING—O. E. Reynolds, West Nicholson; H. H. Mitchel, Lemon. YORK—W. S. Roland, York.

Extracts from some of the Correspondence.

J. S. ELDER of Beaver county, remarks that "timber belts should be left for the protection of fields. Our county has been cleared without any definite plan unless it was to cut out the timber without regard to plan, economy or real benefit to the farmer."

A. D. WEIR of Butler county, says, "It is evident something must be done in this State to protect our forests from wanton waste, or our State must suffer in the near future from drouth that seems to be inevitable if the destruction of the forests is not arrested."

W. R. SHELMIER of Chester. "Our county supplies very little timber for commercial purposes, but, on the whole, it is tolerably well wooded with a young growth, principally chestnut, used for fencing purposes."

T. SPEAKMAN of the Chadd's Ford Farmers' Club, of Delaware county, writes "The following was approved by the club and ordered to be forwarded to your committee:

"To the Committee on Forests and Forestry, of the Board of Agriculture, State of Pennsylvania:

"In answering the queries propounded by your circular of Septem-

ber 15, Townsend Speakman, a member of the Chadd's Ford Farmer's Club, to whom one of them was referred, has introduced the following, which, together with the answers to your questions, is indorsed by us, and directed to be forwarded to one of your committee:

"We look upon the question referred to as one of vast importance to the present and still more to future generations, and if your Board can, by the agitation of this subject, save the life of a single tree, you will not have labored in vain. Statistics, aided by our own observations, convince us that the wholesale destruction of our native forests is fraught with incalculable danger to the future prosperity of not only the agricultural, but many other interests as well. We believe that the excessive drouths, severe tornadoes, and cyclones, which have of late years prevailed to such an alarming extent, even in our own favored section, owe their destructiveness, in a measure, to stripping the country of its natural protectors—the native forests—and we join with you in calling upon the owners of lands to 'cry a halt' to this, in many cases, wanton destruction, and to urge upon them, in its stead, a better cultivation of the lands already cleared. 'An ounce of prevention is worth a pound of cure,' and it is much easier than to replace them, and though something may be done by the planting of orchards and other trees as wind-breaks and protectors of our springs, still this can only be a partial remedy. What legislation may be necessary and practical we leave for your wisdom to find out and obtain, but any such as will be adequate to meet and check the evil will, we fear, be difficult to procure, owing to the inherent rights of individual landowners and their jealousy of any interference in the disposal of the product of the soil, as their best judgment may suggest. All the aid that we can give your Board towards the education of public sentiment on this important subject, or in the procurement of suitable legislation, will be most cheerfully rendered by the club.

"The answers to your queries can be, at best, but mere guess work, but are given in our best knowledge and belief."

JOHN C. McALLISTER of Elk county. "I believe that the time has not yet arrived when the cultivation of forest trees would be successful for various reasons. The first is the large amount of old timber yet remaining, renders it unnecessary at present; and men will not engage in a business if not forced to, in which they will not be likely to reap any satisfactory returns. Another, is the large amount of young timber springing up, where the old timber is removed, and the land is not cultivated, and which will take the place of the old in time."

R. M. McDEVIT of Huntingdon county. "The destruction of forest timber is rapidly on the increase, and is only supplied by the slow process of nature. Forests of some kinds of timber will recuperate much more rapidly than others, but there is only a small proportion of tillable land that has not already been stripped of timber for agricultural purposes, while the rapidly increasing demand for lumber, and the wants of our extensive iron manufactories create a demand for charcoal, which is making indiscriminate havoc of the mountain timber. In some sections we have large forests of young chestnut, which grow rapidly, on most soils, and is valuable for fencing, and for which there soon will be a largely increased demand, as soon as the new tanning process comes into use. Our forest fires are almost invariably occasioned either by incendiaries or by railroads, and against the latter there seems to be no protection."



Mr. J. B. CONSER of Jefferson county. "If the men and legislators of our day had the best interests of our race in the aggregate at heart, and some real interest in the welfare of the generations which are to come, it would not be long before a law similar to the following, would be and abide upon all our statute books, as permanently as the laws of the Medes and Persians, which changeth not. Let there be a law passed compelling every owner of land of fifty acres and upward, to retain of the original forest, or plant in timber to be kept for that purpose, one acre for every ten owned, and that to be inspected by Government, and to be kept in such condition as to be absolutely proof against forest fires."

JOHNSON MILLER of Lancaster county. "I believe the idea should be established to induce our farmers to plant more trees. It is, in my opinion, a very important matter, and should engage the attention of every person in the State."

H. C. FALLS of Lawrence county. "I have looked at this question of our forests, in its past, present and future effects, and it is very evident that the destruction of our forest timber is going to have a telling effect on the country, in many ways, such as the health of our people, the productions of the soil, in large floods ending in long dry spells, and drying up our sparkling springs and increasing the timber demand for useful purposes, when it is not to be had."

Mr. GEORGE W. KLINE of Lebanon county. "As far as I know all timber land of original growth in the farming districts when cleared is at once cultivated and not reproduced; and I believe if the destruction of heavy timber continues in the same ratio as during the last fifteen years, and since the introduction of that modern 'fiend,' the portable saw-mill, that in fifteen years more there will be none left. The acreage of woodland along the South mountain, on Cornwall hills, has not been much reduced within the last twenty years, in fact greater precautions have been taken to increase and improve the woodland, especially that belonging to the Cornwall estate of the Coleman heirs, by fencing in all the sprouts to keep off cattle that farmers persist in driving to the hills in summer time for free pasture. I venture the opinion that the Cornwall estate has put up fifty miles of fencing through and around their woodland, which, allowing 500 panels per mile, at sixty cents per panel for worm fence, represents an investment of \$15,000, merely for the protection of woodland, all of which might have been saved if our legislators had pluck enough to have a proper protective law enacted."

D. SIMPSON, JR., McKean county. "Hemlock is being cut very fast at the present time. The bark is selling at \$4.50 per cord, and the logs at from \$3.00 to \$4.00 per 'M.' 'Tis said that at the present rate of cutting it will not last much more than ten years."

JOSEPH CAMPBELL of Mifflin county. "We have special legislation to protect the young timber in this county, and it is generally respected. Your committee is doing good work by calling attention to the reckless waste of timber."

WILLIAM CROMWELL of Pike county. "It is safe to say that nine-tenths of the forest fires in Pike and Wayne are principally attributable to the carelessness of railroad employes."

J. W. ALLEN of Potter county. "Our forests are very extensive and nearly all kinds of timber is advancing in value. Several large tanneries lately built and under construction will use up the hemlock in the county in the course of the next fifteen to twenty years. Very

few of our citizens seem to take any interest in devising means to protect the forests from destruction."

J. M. HAY of Somerset. "Timber is very plenty in this county, and people are more anxious to destroy than to grow timber, making farms out of what was a nice forest of timber a few years ago."

LAFAYETTE GRAY, Tioga county. "Our noble forests are disappearing like the dew in the morning. We ask where will the next generation get their building material, fencing, &c.? and the answer comes quick and fast, how can I live and keep the timber? or how can I get rich as easy as to cut the forest down?"

WILLIAM GATES of Venango county. "We have an abundance of young timber for fencing purposes, but old, sound timber is becoming scarce and in great demand. Forest fires nearly all start from sparks from locomotives on railroads."

F. R. MILLER of Warren county. "As to the kind of legislation needed, there should be exempt from taxation all land that may hereafter be fully planted with valuable timber trees, and the trees reasonably well cared for, for a term not exceeding fifteen or twenty years. In fixing valuations for tax purposes, assessors should discriminate in favor of land growing natural young valuable timber. Also have something of tree culture taught in our common schools, by requiring school directors to plant and care for a good variety of trees in every school ground, and teach scholars both the common and scientific name of every tree."

T. J. CROCKER, Wayne county. "The forests standing at the present time have little of the value compared with that of a century ago. The lofty pines which then lined the streams and crowned the hills have been removed, and the hemlock, once considered a nuisance, has become valuable."

Hon. N. F. UNDERWOOD, Wayne county. "My estimate of the timber supply in this county is based upon a personal knowledge of twenty-five years' experience in the lumber business. Yet it can only be approximated. Nine or ten tanneries are now getting their bark, hemlock, in part, at least, from this county, and use up yearly say thirty-five thousand cords. Some of them can run but a year or two longer. Those best supplied will have exhausted their entire stock of bark in from five to eight years."

JOHN BEATY, Westmoreland county. "The legislation we need is lower the value on woodland. We have so many portable saw mills in our county at this time (twenty years ago we had none), that thousands of feet of lumber are thrown on the market weekly, and in twenty years our timber will be exhausted, and what little will be left will be cleared out for pasture. And without the fallen leaf and underbrush to protect the roots, trees will in a few years decay, leaving the farmers bare of timber, scarce of water, and exposed to violent storms. By lowering the taxes we encourage tree planting."

JAMES MILES, Erie county, a member of the committee, says: "This county has so little waste land that it is not probable that forest culture will receive the attention it should, for even its climatic influences."

Mr. J. A. HERR of Clinton county, a member of the committee, expresses the hope that the *press* may be used more extensively to warn the public of the dire results of wantonly destroying our forests, in cutting trees merely for the bark."

H. L. SCOTT, Bradford county, also a member of the committee, re-



marks: "We, in this section of the State, have not given the subject that attention that would naturally be given to it in the older portions. We have not so much felt the necessity of it. This and the adjoining counties are comparatively new, particularly when compared with the eastern portions of the State. Land is still to some extent being cleared for farming purposes, and large amounts of timber are being cut for bark and lumber. Under such circumstances it would not be expected that we would realize the importance of this subject as fully as those residing in the older portions of the State. Neither will the great mass of our people fully realize it till it is too late."

While they do not yet see the necessity of doing something to protect our forests, yet there are portions of our county in which they begin to see the effects of its removal. It is seen in the failure of our streams, those that a few years ago furnished sufficient water for our mills are now failing, and each year it seems to be growing worse. It is also seen in the rapid rise of the small streams when there is much rain, doing much damage and then quickly subsiding. The removal of the forests prevents the water being retained, and it passes off quickly. It is also seen in the failure of springs that used to be never-failing. In fact there are various ways in which some portions of our county begin to feel the harm that is being done by the removal of our forests, and yet it may be said that we are but just beginning to feel what older portions of the State have been a long time realizing. I know of no remedy that can be applied to make our people realize the great harm that is being done before it is too late. It is not the ax alone that is doing the damage, but forest fires seem to increase in frequency. I agree with Mr. Sechler, of Montour, in his report, that sportsmen and railroad companies cause much of these fires, and that the railroad company ought to pay damages. I know of no sound reason why a railroad company should not be answerable for the damage caused by their carelessness. I am satisfied they could use means to prevent much of the fires they cause.

Professor THOMAS MEEHAN, of Philadelphia, also a member of the committee, who had the opportunity to examine the preceding statements in this report, contributes the following:

"The facts brought to light through these inquiries seem to me to be of great value. In my address to the Board at Harrisburg a few years ago, I gave it as the result of my own observations, that about one-fourth of the area of the State was still under forest. It will be seen by taking the averages of the counties as here given, that the result is exactly one-fourth. It may be said that the figures are not exact, some estimates would be too high, and some too low, but the average is no doubt correct; and it may be assumed that for all practicable purposes, we are correct in saying, the forestry area of Pennsylvania is about one-fourth of its total acreage. This is quite as much as an agricultural State like Pennsylvania ought to have, and if this proportion can be maintained, it would be all that is desirable. But from the replies to the second question we gather that not three per cent. of the woodland cleared is allowed to grow up again as timber. The result must be in time the total destruction of Pennsylvania forest, unless something effectual is done either to preserve the young growth following a clearing, or to plant new forests to about the same extent as those cleared away. In case anything feasible in this direction can be attempted, the facts gathered under questions three, four and five will be of inestimable value. We find, for instance, that there are

eleven distinct varieties of trees named as flourishing well as timber trees in our State, and for which there is more or less demand; while under the general name of oak, hickory, ash, pine and elm, almost as many more varieties are included, making, say, at least twenty kinds of timber-producing trees, more or less adapted to our State. Some seem adapted to a wide area, the chestnut, for instance, being reported as doing well in forty-six different counties, in forty-one of which it is in good demand. Some trees are widely adapted to our soil and climate, for which there seems little demand; beech, thriving in fourteen counties, is only much demanded in four, and maple, probably the sugar maple at home, in twenty-seven counties, is appreciated in only six. We seem worse off for pine than for any other kind. White pine and yellow pine (which in Pennsylvania means *Pinus rigida*, or the pitch pine of more northern States) are no doubt chiefly intended. It is reported as doing well now in twenty-four counties, while thirty-four report an active demand for it. By these comparisons and others which may be made, we see how very important the facts given may be in connection with any forestry effort the State may make. With such a great variety doing well, and in good demand, it is no wonder little is suggested under question seven. There are many kinds in other countries or in other States popular, which are found by cultivation to grow very well in the State, for instance, the catalpa, alianthus, the northern shingle cypress, the Shingle oak, the common cherry, which is much valued by cabinet makers, and so on. With so much natural value in our forests, it is hardly to be expected that much should be known about the value of any additions from outside sources.

"The great point of interest centers around the preservation of old forests, and the encouragement of new plantations. Trees, like any other organic beings, must die in time. Owners of forests who cut for lumber, only anticipate by a few years the work of nature. No legislation can prevent this ultimate result. New forests must come from young trees springing naturally from where old ones stood, or by wholly new plantings. The figures obtained by this report show that where the forests are cut the land is cleared, and very little is left for reforestation. It is not likely that any legislation can prevent this. It is difficult to prevent an owner from doing what he likes with his own, and unless the owner of such land was to receive compensation out of the taxes for being compelled to keep in forest that which he could turn to better advantage, it is not likely any legislation could be had to compel him to do so.

"We seem to be thrown wholly on the question, How to encourage new forest plantations?

"Considering how recently it is that we have had nearly all the timber we required for barely the cost of cutting, how that not long ago, timber was incumbrance, which lessened rather than added to the value of farms, it is surprising to find so many answers inclined to favor profitable planting. It is evident that the popular mind is running in this direction, and it is fortunate, as it is already apparent from our figures, the direction in which we shall ultimately have to go. It seems to me that what we want now, is some practicable demonstration of the value of artificial plantations. It would be of immense service to a proper understanding of this subject, if every county agricultural society would undertake the planting and oversight of, say ten to twenty acres, choosing the trees best adapted to the soils, as in-



licated by this report, and keeping accurate accounts of the value of the land at the time of planting, and all costs of planting and care, giving the annual report of this Board, of the progress and cost of the work. The State might make a small appropriation to have this work carried out under the care of the county societies. Thus in a very few years, we should have the exact figures in regard to forestry culture. We should know for certain, from the averages in each county, whether there is profit or loss in it, and just how much profit or how much loss, if the returns are profitable, there will need no further inducements for private individuals or companies to embark in the business. If there is loss it will then be a question as to what legislation would be desirable to protect this great public interest, so that those who engage in it may have a fair return for their enterprise. It seems to me it is a proper time now for the Board to take active measures to introduce some such a comprehensive forestry system, with the great object of getting at the exact facts for the public good.

"The subject of forest fires need not be considered in connection with such a scheme as this. There can be no forest fires where undergrowth is not permitted. It is the accumulation of dead branches out of dry material among the mass of living undergrowth which makes a forest fire so destructive. In the new system forestry which will follow when all the old forests are gone, none of this ought in any case to be permitted. The young trees should be cultivated for a few years like a corn field, till they grow up to shade the ground, when nothing else of consequence would grow beneath them. How much may be done to prevent fires in existing forests is a question wholly distinct from that which is to be the great question, viz: The planting of new forests. The opinions offered by our correspondents, show by their opposite characters how unsatisfactory any proposition would be. Railroads, hunters, camp-fires, or mere malice may set woods on fire. It may be desirable to insist on the careless parties sharing the damages, or receiving punishment; but no matter what is done in this way, there will never be absolute security against forest fires so long as the accumulation of dead material gathered together through ages remain under natural forests, or the trimmings of the lumbermen remain to give strength to a fire once started by accident or design. Something might be devised out of the counsel of correspondents to make them less frequent, but it is not until the new era of artificial forest culture shall have set in, in which, from the start, underbrush shall have no place, that we may hope for entire freedom from these great calamities.

"Should such a scheme of county experiments, as the facts brought out by this report of the committee seem to render desirable, be eventually carried out, it would very much aid the success of the work, if intelligent rules for forest culture adapted to the varieties popular in our State, were prepared by the Board.

"I embrace this opportunity to return my sincere thanks to the many kind correspondents throughout the State, for their promptness in returning answers to the circulars issued by the committee, and for the great interest that have generally manifested in this forthcoming report, whilst at the same time I was disappointed, and very much regret, that no returns were received from the counties of Cameron, Carbon, Clarion, Clearfield, Fulton, Lehigh, Monroe and Schuylkill. In the eight delinquent counties above named, the same number of circulars were sent out as were sent to other counties.

"And now in conclusion. Any one who may be interested in this important subject, and will take the time and trouble to examine this report, notice the tabular statements and carefully expressed opinions of the many correspondents to the questions submitted to them, as also the views of some of the members of the committee, will observe that whilst there may be some slight difference of opinion found in the answers to the several questions, as well as in some of the views of correspondents and members of the committee, yet it is obvious that on the great and all important subject *of the care of our forests*, there is a most decided unanimity of sentiment that the demand and consumption of timber from all parts of the State is rapidly diminishing our forests, and judging from the past and present demands, it is not a very difficult problem to calculate just how long it will take to use up our remaining supply of native timber. When we take into consideration this constant and increasing call for timber required for our manufactures, for building purposes, for railroad ties, for telegraph poles, for fences, &c., it is easily demonstrated that unless replanting is strongly urged and actually carried into effect, the supply of some of the varieties most in demand must soon run out.

"I am a believer in the doctrine that if this wholesale waste of our forests is permitted to go on as it seems to be progressing, without preparing and providing for the introduction of a new growth, that it will eventually not only severely affect the business relations of the State, but will also seriously impair the health and comfort of our people. 'Trees are the dominating members of the vegetable kingdom. They are necessary factors in the sum total of those influences which constitute the environment of animal life. Trees, by absorbing carbonic gas and emitting oxygen, act as agents in rendering the atmosphere life-sustaining. By interposing their foliage between the sun and the earth, they serve a useful purpose in sheltering the soil from heat, and, as conductors of heat, in equalizing the temperature of the earth and the air. The forest, too, guards the soil against abrasion and displacement from torrents and overflows, and thus again exerts its conservative influence for man's good. We need trees for the delight they afford, as at once the most majestic, imposing, and beautiful of nature's vegetable forms. The State cannot afford, and should not much longer withhold, or refuse to give the subject of our forests its most serious attention.'

"Governor Hartranft, in one of his messages to the Legislature, said: 'I especially invite your attention to an evil of considerable magnitude, which every year grows more aggravated, and in certain regions at times is the occasion of serious apprehension and loss; I refer to the whole sale destruction of our forests.'

"This subject has awakened the people in some of our sister States, where their own necessities have caused them to offer liberal premiums for the encouragement of tree planting. In Minnesota they have organized forestry associations, which in 1877, was instrumental in having from eight to ten million of trees planted. A day, the first Tuesday in May, is especially set apart, and is called 'Arbor day,' or tree-planting day. Efforts have also been made in other States for the observance of similar occasions; Governor Foster, of Ohio, appointed April 27, as 'Arbor day' in that State, and Governor Nance, of Nebraska, appointed April 19, and urged everybody in the State to plant a tree on that day; and this, we are told, is only the beginning of the great and very necessary enterprise. When we thus see this



important movement going on in other States, shall the people of Pennsylvania fold their arms, close their eyes, and do nothing? It is sincerely hoped that they will jealously guard their own interests. Let them but remember, that from year to year, as our population and our industries increase, the demand for timber will proportionally increase, and to meet these wants our forests must surely give out, unless the supply is kept up, and this can only be done by resorting to tree planting. And now, if our people have so sadly heretofore neglected these admonitions, by continuing inactive, we think it is high time and we urge it upon them, to wake up, and no longer refrain from giving the subject their most earnest attention. And how best can this be accomplished? We think the best plan is through intelligent legislation, by local agricultural societies, and the support of the State Board of Agriculture."

#### AN ACT

To Encourage the Planting of Trees along the Roadsides in this Commonwealth.

SECTION 1. *Be it enacted, &c.*, That any person liable to road tax, who shall transplant to the side of the public highway, on his own premises, any fruit, shade trees or forest trees of a suitable size, shall be allowed by the supervisor of roads where roads run through or adjoin cultivated fields in abatement of his road tax, one dollar for every four trees set out; but no row of elms shall be placed nearer than seventy feet, no row of maples or other forest trees nearer than fifty feet except locust, which may be set thirty feet apart; and no allowance, as before mentioned, shall be made, unless such trees shall have been set out the year previous to the demand for such abatement of tax, and are living and well protected from animals at the time of such demand.

SECTION 2. Any trees transplanted to the side of the public highway as aforesaid, in place of trees which have died, shall be allowed for in the same manner and on the same conditions as in the preceding section.

SECTION 3. No person shall be allowed an abatement of his highway tax as aforesaid more than one quarter of his annual highway tax, and no one shall receive an abatement for trees planted previous to the passage of this act.

SECTION 4. Any person who shall cut down, kill or injure any living tree planted as aforesaid, shall pay to the supervisor of roads as aforesaid fifty cents for each tree cut down, killed or removed, to be collected as other road taxes are now collected.

APPROVED—The second of May 1887.

HENRY M. HOYT.

#### AN ACT

For the Encouragement of Forest Culture, and Providing Penalties for the Injury and Destruction of Forests.

SECTION 1. *Be it enacted, &c.*, That in consideration of the public benefit to be derived from the planting and cultivation of forest or timber trees, the owner or owners of any land in this Commonwealth planted with forest or timber trees in number not less than twelve hundred to the acre, shall, on making due proof thereof, be entitled to receive annually from the commissioners of their respective counties, during the period that the said trees are maintained in sound condition upon the said land, the following sums of money:

For a period of ten years after the land has been so planted, a sum equal to ninety per centum of all the taxes annually assessed and paid upon the said land, or so much of the said ninety per centum as shall not exceed the sum of forty-five cents per acre.

For a second period of ten years, a sum equal to eighty per centum of said taxes, or so much of eighty per centum as shall not exceed the sum for forty cents per acre.

For a third and final period of ten years, a sum equal to fifty per centum of said taxes, or so much of the said fifty per centum as shall not exceed the sum of twenty-five cents per acre:

*Provided*, That it shall be lawful for the owner or owners of the said land, after the same has been so planted for at least ten years, to thin out and reduce the number of trees growing thereon to not less than six hundred to the acre, so long as no portion of said land be absolutely cleared of the said trees:

*And provided also*, That the benefits of this act shall not be extended to nurserymen or others growing trees for sale for future planting.

SECTION 2. The owner or owners of forest or timber land, in the Commonwealth, which has been cleared of merchantable timber, who shall, within one year after the said land has been so cleared, have given notice to the commissioners of their respective counties that the said land is to be maintained in timber, and who shall maintain upon the said land young forest or timber trees in sound condition, in number at least twelve hundred to the acre, shall, on making due proof thereof, be entitled to receive annually from the commissioners of their respective counties the sums of money mentioned in the first section of this act:

*Provided*, The first period of ten years shall be counted from the time that the said land has been cleared of merchantable timber, and, that after the said first period of ten years, the number of trees upon the said land may be reduced as in the first section is provided.

SECTION 3. Any person or persons, who shall wilfully or carelessly cut bark from or otherwise cut, burn or injure any tree, plant shrub or sprout planted, growing or being on any land of this Commonwealth, without the consent of the owner or owners thereof first had and obtained, or who, without such consent, shall kindle, or cause to be kindled, a fire on any forest or timber land in this Commonwealth, or who shall carry into or over any forest or timber land, any lighted candle, lamp or torch or other fire without having the same secured in a lantern or other closed vessel, or who shall discharge or set off fireworks of any kind on said land or among the trees thereon, or who



shall wilfully or carelessly burn or fire upon his or their own land, or that of others, any tree, brush, stubble, or other combustible material whereby fire shall be communicated to the leaves, brush or timber upon any forest or timber lands belonging to other parties, shall be subject to a penalty of fifty dollars for each offense committed, with the whole costs of suit, one-half to go to the party or parties injured, and the other half to the school fund of the district in which the offense is committed :

*Provided*, That if the defendant or defendants neglect or refuse to pay at once the penalty imposed and costs, or shall not enter sufficient bail for the payment of the same within ten days, he or they shall be committed to the common jail of the said county for a period of not less than one day for each dollar of the penalty imposed :

*And provided*, When the penalty imposed is above five dollars, the defendant or defendants may enter into a recognizance with good security, to answer said complaint on a charge of misdemeanor, before the court of quarter sessions of the peace of the county in which the offense is committed, which court, on conviction of the defendant or defendants of the offense so charged, and failure to pay the penalty imposed by this act, with costs, shall commit said defendant or defendants to the common jail of the county for a period of not less than one day for each dollar of penalty imposed.

SECTION 4. Any justice of the peace or alderman, upon information or complaint made before him by the affidavit of one or more persons, of the violation of this act by one or more persons, shall issue his warrant to any constable or police officer, to cause such person or persons to be arrested and brought before the said justice of the peace or alderman, who shall hear and determine the guilt or innocence of the person or persons so charged, who, if convicted of the said offense, shall be sentenced to pay the penalty aforesaid.

SECTION 5. The commissioners of each county shall, within one month after the passage of this act, cause the same to be published, one or more times, in one newspaper of general circulation in their respective counties.

APPROVED—The first day of June, A. D. 1887.

JAMES A. BEAVER.

LIST OF TREES FOR ORNAMENT AND PRACTICAL USE.

By JOSIAH HOOPES, *West Chester, Pa.*

[Taken from Annual Report of the Board.]

SCIENTIFIC NAME.	COMMON NAME.	RECOMMENDED FOR	SEEDS MATURE.	DESCRIPTION OF SEEDS.
<i>Acer campestre</i> , L.	English or corked-bark Maple,	Manufacturing, Fuel, Ornament,	September,	Key-fruit; wing widely divergent.
<i>Do. dasycarpum</i> , Ehr.	White, Silver, or Soft Maple,	Ornament, Sugar,	May,	do. do. large.
<i>Do. platanoides</i> , L.	Norway Maple,	do. do.	Sept. and Oct.	do. do. divaricate.
<i>Do. pseudo-platanus</i> , L.	Sycamore Maple,	do. do.	do. do.	do. do. somewhat diverging.
<i>Do. rubrum</i> , L.	Red or Swamp Maple,	do. do.	September,	do. do. small, diverging.
<i>Do. saccharinum</i> , Wang.	Sugar, Rock, or Hard Maple,	do. do.	do. do.	do. do. slightly diverging.
<i>Do. do.</i> var. <i>nigrum</i> ,	Black Sugar Maple,	do. do.	do. do.	do. do. do.
<i>Abies alba</i> , Michx.	White or Single Spruce,	do. do.	October,	Seeds small, very small wings; cones small.
<i>Abies balsamea</i> , Marshall.	Balsam, or Balm of Gilead Fir,	do. do.	do. do.	Seeds small, in rather large cones. Cones.
<i>Do. canadensis</i> , Michx.	Common Hemlock Spruce,	do. do.	do. do.	Seeds very small, small wings, very small
<i>Do. excelsa</i> , D. C.	Norway Spruce,	do. do.	do. do.	Seeds small, small wings, long cones.
<i>Do. Nordmanniana</i> , Link.	Nordmann's Silver Fir,	do. do.	do. do.	Seeds medium, small wings, long cones.
<i>Do. orientalis</i> , Potr.	O. lental Spruce,	do. do.	September,	Seeds very small, do. cones medium.
<i>Esculus flava</i> , Ait.	Sweet Buckeye,	do. do.	October,	Large nuts in fleshy covering.
<i>Alnus glandulosa</i> , Desf.	Fetid, or Ohio Buckeye,	do. do.	do. do.	do. do. do.
<i>Do. glabra</i> , Willd.	European Horse Chestnut,	do. do.	do. do.	do. do. do.
<i>Do. Hippocastanum</i> , L.	Tree of Heaven, or Paradise,	do. do.	do. do.	do. do. do.
<i>Betula alba</i> , L.	White Birch,	do. do.	do. do.	Key-fruit, small.
<i>Do. do.</i> var. <i>populifolia</i> , Spach	American White Birch,	do. do.	do. do.	Minute winged nutlets.
<i>Do. lenta</i> , L.	Cherry, Sweet, or Black Birch,	do. do.	September,	do. do. do.
<i>Do. lutea</i> , Michx.	Yellow or Gray Birch,	do. do.	August,	do. do. do.
<i>Do. nigra</i> , L.	River or Red Birch,	do. do.	do. do.	do. do. do.
<i>Do. papyracea</i> , Ait.	Paper or Canoe Birch,	do. do.	do. do.	do. do. do.
<i>Carya alba</i> , Nutt.	Shellbark or Shag-bark Hickory,	Nuts, Timber, Fuel,	October,	Nuts with leather covering.
<i>Do. amara</i> , Nutt.	Bitter-nut or Swamp Hickory,	Manf., Fuel,	do. do.	do. do. do.
<i>Do. microcarpa</i> , Nutt.	Small-fruited Hickory,	do. do.	do. do.	do. do. do.
<i>Do. oliviformis</i> , Nutt.	Pecan-nut,	do. do.	do. do.	do. do. do.
<i>Do. porina</i> , Nutt.	Pig-nut or Broom Hickory,	do. do.	do. do.	do. do. do.
<i>Do. sulcata</i> , Nutt.	Western Shellbark Hickory,	do. do.	do. do.	do. do. do.
<i>Do. tomentosa</i> , Nutt.	Mocker Nut. White-heart Hickory,	do. do.	do. do.	do. do. do.
<i>Castanea vesca</i> , L.	Chestnut,	Timber, Nuts,	do. do.	Nuts in prickly covering.
<i>Do. pumila</i> , Michx.	Chinquapin,	Nuts,	do. do.	do. do. do.



List of Trees—Continued.

SCIENTIFIC NAME.	COMMON NAME.	RECOMMENDED FOR	SEEDS MATURE.	DESCRIPTION OF SEEDS.
<i>Catalpa bignonioides</i> , Walt.	Catalpa, Indian Bean,	Timber, Ornament,	October.	Seeds small, in long capsules.
<i>Celtis occidentalis</i> , L.	Sugarberry, Hackberry, Nettle-tree,	do.	September,	Drupes, covering thin.
<i>Cornus Florida</i> , L.	Flowering Dogwood,	do.	do.	do. berry-like.
<i>Crataegus coccinea</i> , L.	Scarlet-fruited Thorn,	Hedging, Ornament,	October,	Seeds bony, in a fleshy fruit.
<i>Crataegus crus-galli</i> , L.	Cockspur Thorn,	do.	do.	do.
<i>Cupressus thyoides</i> , L.	White Cedar,	Timber, do.	do.	Seeds very small, in very small cones.
<i>Diospyros Virginiana</i> , L.	Date Plum, Persimmon,	Manf., Fuel, Ornament,	November,	Large flat seeds, in a plum-like fruit.
<i>Fagus sylvatica</i> , L.	American Beech,	do.	September,	Angular nuts in a calyx or cup.
<i>Fraxinus Americana</i> , L.	European White Ash,	do.	do.	do.
<i>Do. excelsior</i> , L.	European Ash,	Manf., Ornament,	Sept. and Oct.	Seeds winged at the apex. Key-fruit.
<i>Do. quadrangulata</i> , Michx.	Blue Ash,	do.	October,	Seeds encircled by the wing. do.
<i>Do. sambucifolia</i> , Lam.	Black or Water Ash,	do.	Sept. and Oct.	do.
<i>Do. vi. idis</i> , Michx.	Green Ash,	do.	do.	Seeds winged at the apex. do.
<i>Gleditsia triacanthos</i> , L.	Honey or Three-thorned Locust,	Hedging, Ornament,	September,	Seeds nut-like in long pods. do.
<i>Gymnocladus Canadensis</i> , Lam.	Kentucky Coffee,	Manf., Ornament,	October,	Seeds in large 4-winged dry fruit.
<i>Halesia tetraetara</i> , L.	Snowdrop or Silver Bell tree,	Ornament,	do.	Nutlets in red drupes.
<i>Ilex opaca</i> , Ait.	American Holly,	do.	September,	Large hard-shell nuts; drupe-like.
<i>Juglans cinerea</i> , L.	Butternut, White Walnut,	do.	do.	do.
<i>Do. nigra</i> , L.	Black Walnut,	do.	do.	do.
<i>Do. regia</i> , L.	English Walnut,	do.	do.	Seeds bony, in berry-like fruit.
<i>Juniperus Virginiana</i> , L.	Red Cedar,	Timber,	September,	Seeds in inflated capsules.
<i>Kolreuteria paniculata</i> , Lam.	American Larch,	do.	October,	Winged seeds in small cones.
<i>Larix Americana</i> , Michx.	European Larch,	do.	do.	do.
<i>Do. Europaea</i> , D. C.	Sweet Gum, Bilstead,	do.	do.	Seeds with a wing-angled coat.
<i>Liquidambar styraciflua</i> , L.	Tulip tree, Tulip Poplar, wrongly,	do.	do.	Key-fruit like in a cone.
<i>Liriodendron tulipifera</i> , L.	Cucumber tree,	do.	do.	Berry-like seeds, in cone-like fruit.
<i>Magnolia acuminata</i> , L.	Chinese White Magnolia,	do.	do.	do.
<i>Do. conspicua</i>	Ear-leaved Umbrella tree,	do.	do.	do.
<i>Do. Fraseri</i> , Walt.	Swamp Magnolia,	do.	do.	do.
<i>Do. glauca</i> , L.	Great-leaved Magnolia,	do.	do.	do.
<i>Do. macrophylla</i> , Michx.	Umbrella tree,	do.	do.	do.
<i>Do. Umbrellata</i> , Lam.	Osage Orange,	do.	do.	do.
<i>Maclura aurantiaca</i> , Nutt.	White-fruited Mulberry,	Hedging, Timber,	September,	Small nutlets in an orange-like fruit.
<i>Morus alba</i> , L.	Red fruited Mulberry,	Fruit, do.	July,	Seeds small, in blackberry-like fruit.
<i>Do. rubra</i> , L.	do.	do.	do.	do.

List of Trees—Continued.

SCIENTIFIC NAME.	COMMON NAME.	RECOMMENDED FOR	SEEDS MATURE.	DESCRIPTION OF SEEDS.
<i>Negundo aceroides</i> , Moench,	Ash-leaved Maple, Box Elder,	Shade, Shelter, Timber,	September,	Key-fruit, small.
<i>Nyssa multiflora</i> , Wang.	Black or Sour Gum, Tupelo,	Ornament Fuel, Manf.,	do.	Bony seed in a fleshy drupe.
<i>Pinus Austrica</i> , Hoess,	Austrian Pine,	do.	October,	Winged seed in cones.
<i>Do. mitis</i> , Michx.	Short-leaved Yellow Pine,	do.	do.	do.
<i>Do. pungens</i> , Michx.	Table Mountain Pine,	do.	do.	do.
<i>Do. resinosa</i> , Ait.	Red or Resinous Pine,	do.	do.	do.
<i>Do. rigida</i> , Mill.	Pitch Pine,	do.	do.	do.
<i>Do. strobus</i> , L.	White or Weymouth Pine,	do.	do.	do.
<i>Do. sylvestris</i> , L.	Scotch Pine or Fir,	do.	do.	Small nuts in round heads or balls.
<i>Platanus occidentalis</i> , L.	American Plane, Buttonwood, Sycamore,	Shade, Timber,	do.	do.
<i>Do. orientalis</i> , L.	The Oriental Plane or Sycamore,	do.	do.	do.
<i>Populus alba</i> , L.	White Alder or Poplar,	do.	May,	Seeds minute. (Propag'd from cut'gs.)
<i>Do. angulata</i> , Ait.	Angled Cottonwood,	Timber, Street planting,	do.	do.
<i>Do. balsamifera</i> , L.	Balm of Gilead,	do.	do.	do.
<i>Do. var. canadensis</i> ,	Large-toothed Aspen,	do.	do.	do.
<i>Do. quadridentata</i> , Michx.	Downy Poplar,	do.	do.	do.
<i>Do. heterophylla</i> , L.	Cottonwood,	do.	do.	do.
<i>Do. monilifera</i> , Ait.	American Aspen,	Wind break, Street planting,	do.	do.
<i>Do. tremuloides</i> , Michx.	ble to sucker freely, but are rapid grow	Ornament,	do.	do.
(NOTE.—All the poplars are lia	Prunus Avium, L.	ing hardy trees.)	do.	do.
<i>Prunus Avium</i> , L.	Common Black Cherry,	Stocks, Timber, Fruit,	June,	Bony stone in a fleshy drupe.
<i>Do. Mahaleb</i> , L.	Mahaleb or Perfumed Cherry,	do.	August,	do.
<i>Do. Padus</i> , L.	European Bird Cherry,	do.	do.	do.
<i>Do. Pennsylvanica</i> , L.	Wild Red Cherry,	do.	do.	do.
<i>Do. serotina</i> , Ehrhart,	Wild Black Cherry,	do.	do.	Seeds in berry-like fruit.
<i>Pyrus Americana</i> , D. C.	American Mountain Ash,	do.	do.	do.
<i>Do. aucuparia</i> , L.	European Mountain Ash,	do.	do.	Fruit similar to cultivated apple.
<i>Do. coronaria</i> , L.	American Crab apple,	do.	do.	Seeds in edible, fleshy fruits.
<i>Do. communis</i> , L.	Common Pear tree,	Fruit, Timber,	Autumn,	do.
(The species of Mt. Ash are	subject to the depredations of a destruc	tive wood-borer.)	do.	do.
<i>Quercus alba</i> , L.	White Oak,	Timber, Ornament,	October,	Nut or acorn, in a cup.
<i>Do. bicolor</i> , Willd.	Swamp White Oak,	do.	do.	do.
<i>Do. coccinea</i> , Wang.	Scarlet Oak,	do.	do.	do.
<i>Do. var. tinctoria</i> , Gray,	Black Oak,	do.	do.	do.
<i>Do. var. ambigua</i> , Gray,	Gray Oak,	do.	do.	do.
<i>Do. falcata</i> , Michx.	Spanish Oak,	do.	do.	do.
<i>Do. imbricaria</i> , Michx.	Laurel or Shingle Oak,	Tanning,	do.	do.



## List of Trees—Continued.

SCIENTIFIC NAME.	COMMON NAME.	RECOMMENDED FOR	SEEDS MATURE.	DESCRIPTION OF SEEDS.
<i>Quercus lyrata</i> , Walt.	Over Cup.	Timber, Ornament,	October,	Nut or acorn, in a cup.
Do. <i>macrocarpa</i> , Michx.	Black Jack.	do.	do.	do.
Do. <i>obtusiloba</i> , Michx.	Post or Barren Oak.	Fuel, Ornament.	do.	do.
Do. <i>palustris</i> , Dul. Ro.	Pin or Swamp Spanish Oak.	Timber, Ornament,	do.	do.
Do. <i>phellos</i> , L.	Willow or Pigeon Oak.	do.	do.	do.
Do. <i>prinus</i> , L.	Chestnut Oak.	do.	do.	do.
Do. var. <i>monticola</i> , Michx.	Rock Chestnut Oak.	do.	do.	do.
Do. var. <i>acuminata</i> , Michx.	Yellow or True Chestnut Oak.	do.	do.	do.
Do. <i>robur</i> , L.	British or Royal Oak.	do.	do.	do.
Do. <i>rubra</i> , L.	Red Oak.	do.	do.	do.
Robinia <i>pseudacacia</i> , L.	Common Locust.	Ornament,	September,	Nut-like seeds in flattened pods.
Do. <i>viscosa</i> , Vent.	Clammy Locust.	do.	do.	do.
<i>Salisburia adiantifolia</i> , Smith.	Maiden Hair tree, Ginkgo.	do.	(?)	do.
<i>Salix alba</i> , L.	White Willow.	Timber, Ornament, Shelter,	May,	Drupe-like fruit standing in a fleshy disk.
Do. <i>Babylonica</i> , Taura.	Babylonian Weeping Willow.	do.	do.	do.
Do. <i>fragilis</i> , L.	Brittle Willow.	Basket work, Ornament,	do.	Minute seeds with tufts of hair.
Do. <i>hielda</i> , Muhl.	Shining Willow.	do.	do.	do.
Do. <i>purpurea</i> , L.	Purple Willow.	Ornament.	do.	do.
Do. <i>viminialis</i> , L.	Basket Osier.	Basket work, Ornament,	do.	do.
<i>Sassafras officinale</i> , Nus.	Sassafras.	do.	do.	do.
<i>Taxodium distichum</i> , Richard.	Bald or Deciduous Cypress.	Official properties, Ornament,	do.	do.
<i>Thuja occidentalis</i> , L.	American Arbor Vitae.	Ornament, Timber.	September,	Fruit a 1-seeded berry or drupe.
<i>Tilia Americana</i> , L.	Basswood.	do.	October,	Small seeds with narrow wings, in globular cones.
<i>Tilia Europea</i> , L.	European Linden.	do.	do.	Small winged seeds in small cones.
<i>Ulmus alata</i> , Michx.	Whahoo or Winged Elm.	do.	do.	Seed, a small pendulous nut.
Do. <i>Americana</i> , L.	American or White Elm.	do.	do.	do.
Do. <i>fulva</i> , Mich.	Slippery or Red Elm.	do.	June,	Small seeds winged all round.
Do. <i>campestris</i> , L.	Common English Elm.	do.	do.	do.
Do. <i>montana</i> , Bank.	Scotch or Wych Elm.	do.	do.	do.
Do. <i>racemosa</i> , Thomas.	Corky hie Elm.	do.	do.	do.
(The foliage of the Elm is fre-	quently destroyed by an Injurious Insect.)	do.	do.	do.

## INDEX BY SUBJECTS.

	Page.		Page.
<i>Abies excelsa</i> (Norway spruce), . . .	78	Discussion on forestry, . . . . .	29-64
Advantages of forests, . . . . .	16	Drainage by forests, . . . . .	22
Alder for planting, . . . . .	75	Early rafting, . . . . .	50
Alanthus for planting, . . . . .	98	Effect of forests on health, . . . . .	16-96
American desert, . . . . .	107	Effect of reforestation, . . . . .	19
Annual rainfall, . . . . .	18-64	Effect of Arbor day planting, . . . . .	35
Annual growth, . . . . .	32	Effect of cannonading on rainfall, . . . . .	114
Annual timber supply, . . . . .	57-64	Epidemic diseases and forests, . . . . .	10
Annual destruction of forests, . . . . .	51	Equilibrium of moisture, . . . . .	12
Answers to questions, . . . . .	120	Estimated amount of timber, . . . . .	120
Appropriation for forestry, . . . . .	49	Evergreen trees, . . . . .	77
Arbor day, . . . . .	27-35-41	Evergreen trees, list of, . . . . .	95
<i>Arbor vite</i> , . . . . .	95	Evergreens for shelter, . . . . .	96
Austrian pine, . . . . .	85	Evaporation in forests, . . . . .	112
Atmospheric precipitation, . . . . .	9	Exemption from taxation, . . . . .	103
Basket willow, . . . . .	76	Experiment stations and forestry, . . . . .	105
Barbed wire fence, . . . . .	116		
Beech for planting, . . . . .	74	Forests as sanitary agents, . . . . .	9-19
Best trees by counties, . . . . .	122-124	effect of, on streams, . . . . .	10
Birch for planting, . . . . .	75	effect of, on disease, . . . . .	10
Birds as foresters, . . . . .	104	effect of, on climate, . . . . .	11-16
Black walnut, . . . . .	72-97	effect of, on humidity, . . . . .	12
Black oak, . . . . .	74	effect of, on ozone, . . . . .	14-15
British provinces, timber in, . . . . .	100	second growth of, . . . . .	33
Bunch planting, . . . . .	79	in Germany, . . . . .	34
Carolina poplar, . . . . .	85	and rainfall, . . . . .	64
Care of nuts for planting, . . . . .	73	in Crawford county, . . . . .	67-68
Causes of rainfall, . . . . .	106	effect of on temperature, . . . . .	11
Central Pennsylvania forests, . . . . .	18-23	Forest fires, . . . . .	21-44-45-118
Chestnut, . . . . .	73	tree-planting, . . . . .	30
Chestnut planting, . . . . .	43	Forestry association, . . . . .	23-27
Chestnut oak, . . . . .	74	law of 1879, . . . . .	38
Climatic effect of forests, . . . . .	11-16	interests of Pennsylvania, . . . . .	42
Climatic changes, . . . . .	108	legislation, . . . . .	44-49
Conifer seeds, . . . . .	80	practical, . . . . .	56-63
Commission on forestry, . . . . .	28-49	Forests and forestry, . . . . .	115
Conservative influence of forests, . . . . .	9	Gain in value by planting, . . . . .	102
Coöperative forestry, . . . . .	63	Gathering forestry statistics, . . . . .	47
Color of tree seeds, . . . . .	81	German forestry schools, . . . . .	26
Cost of fencing, . . . . .	116	forestry, . . . . .	34
Danger of forest destruction, . . . . .	49-63	Good seed, how to obtain, . . . . .	72
Demand for bark, . . . . .	52	Grass, moisture from, . . . . .	35
Destruction of timber, . . . . .	49	Granting bounties, . . . . .	103
Destruction of forests, . . . . .	129	Growth of trees, . . . . .	60
Deciduous trees, . . . . .	95	Hazel from cuttings, . . . . .	77
Deposite of moisture, . . . . .	106	Hazel for planting, . . . . .	76-77
Duties of public schools, . . . . .	28	Healthfulness of forests, . . . . .	10



	Page.		Page.
Health stations in forests, . . . . .	16-39	Prussian forestry, . . . . .	48
Hemlock bark, . . . . .	52	Private planting, . . . . .	66
Hemlock planting, . . . . .	78	Protection from fires, . . . . .	104
Hemlock seed, . . . . .	78	Profit, planting for, . . . . .	97
Hickory planting, . . . . .	72	Profit of timber culture, . . . . .	125
How to advance forestry, . . . . .	42		
Horticulture in public schools, . . . . .	41	Rainfall, changes in, . . . . .	70
Horse chestnut for shade, . . . . .	95	Rainfall in Ohio, . . . . .	64
Houses, trees around, . . . . .	94	Rainfall in Utah, . . . . .	69
Hoed crops among trees, . . . . .	97	Rainfall and forests, . . . . .	106
How can the State promote forestry, . . . . .	100	Rainfall at Salt Lake, . . . . .	110
Humidity in forests, . . . . .	12-35	Rafts, number of, . . . . .	51
		Rafting, extent of, . . . . .	52
Larch for planting, . . . . .	79	Relative humidity in forests, . . . . .	12
Laws relating to planting, . . . . .	136-137	Reduction of taxes, . . . . .	137
Large areas of forests, . . . . .	62	Rome, trees in, . . . . .	39
Legislation for Pennsylvania, . . . . .	44-49		
Legislation relating to forestry, . . . . .	38-39	Sanitary influence of forests, . . . . .	9-17
Legislation relating to fires, . . . . .	126	Schools and forestry, . . . . .	27-39
Legislation needed, . . . . .	127	Second growth timber, . . . . .	33
Legislation proposed, . . . . .	130-131	Seeds of forest trees, . . . . .	72
List of trees for planting, . . . . .	139-142	Seed bed for chestnuts, . . . . .	74
Live fences, . . . . .	116	Shade trees along roads, . . . . .	37-38
Locust for planting, . . . . .	36-97	Shade, planting for, . . . . .	94
		Shelter, planting for, . . . . .	96
Maples, list of, . . . . .	95	Stock laws, . . . . .	45-49
Malaria in forests, . . . . .	39	State Forestry Commission, . . . . .	49
Making wire fence, . . . . .	117-118	State Forestry Association, . . . . .	49
Mechanical effects of forests, . . . . .	11	State action, . . . . .	56
Moisture in the soil of forests, . . . . .	35	State aid for forestry, . . . . .	135
Moisture of the air in forests, . . . . .	12	Streams, decrease of, . . . . .	64
Mifflin county, forests of, . . . . .	31	Suggestions relating to forestry, . . . . .	88-93
Mill streams and forests, . . . . .	64		
Moisture from forests, . . . . .	35	Taxes, abatement of, . . . . .	136
		Tax for tree planting, . . . . .	103
Natural reproduction of timber, . . . . .	19	Testing seeds, . . . . .	80
New timber areas, . . . . .	121	Timber lands in Canada, . . . . .	100
Nut trees, cultivation of, . . . . .	43	Timber growing, . . . . .	121
		Timber, new now standing, . . . . .	120
Old timber, areas of, . . . . .	120	Trees in public parks, . . . . .	17
Ohio buckeye, . . . . .	95	Trees along public roads, . . . . .	38-39
Ontario, laws of, . . . . .	100	Tree planting, . . . . .	72-81
Ozone, production of, . . . . .	14	Transpiration from trees, . . . . .	12
		Trimming forest trees, . . . . .	30
Pennsylvania (central), forests of, . . . . .	18-23	Trees, deciduous, . . . . .	72
Pennsylvania Forestry Association, . . . . .	23-27		
Pennsylvania forestry legislation, . . . . .	44-49	Water in forests, . . . . .	111
Pennsylvania forests, distribution of, . . . . .	49-55	Waste of timber, . . . . .	129
Pines, list of, . . . . .	95	Waste in fencing, . . . . .	130
Pine, white, . . . . .	79	Water on the farm, . . . . .	24
Pine, yellow, . . . . .	77	Water supply, . . . . .	64
Planting trees, . . . . .	81	Walnut for planting, . . . . .	43-72
Planting for shade, . . . . .	94	White oak for planting, . . . . .	72
shelter, . . . . .	96	White pine, . . . . .	79
profit, . . . . .	97	White spruce, . . . . .	95
Planting along public roads, . . . . .	38-39-136	Winter influenced by forests, . . . . .	12
Potter county, timber in, . . . . .	130	Wire fencing, . . . . .	116
Premiums for planting, . . . . .	102	Willow for profit, . . . . .	76
Practical forestry, . . . . .	56-63		



**END OF NUMBER**